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ABSTRACT

The result of a project effort, this 45-unit curriculum was designed for use in training bituminous coal surface mine personnel in conducting strip mining operations more economically, with good health and safety practices, for environmental control. Containing 1-hour instructional units, the courses can be taught either three hours a night one night a week for 15 weeks, or two hours a night two nights a week for 10 weeks with the last night being a 3-hour session. Instructors for the courses should have expertise in their fields as well as the approval of the advisory committee. Covered are: (1) the economics of strip mining, (2) mandatory health and safety standards, (3) federal and state strip mining laws, (4) various strip mining unit operations, and (5) methods of restoring the land to productive and economical use. Primarily designed for the State of Maryland, this curriculum may be altered to fit programs in other states. (SN)

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THE PENNSYLVANIA STATE UNIVERSITY
COLLEGE OF EARTH AND MINERAL SCIENCES
UNIVERSITY PARK, PENNSYLVANIA

INTEGRATED SURFACE MINING AND RECLAMATION TECHNIQUES A CURRICULUM FOR TRAINING SURFACE MINING PERSONNEL

Submitted to the
Division of Manpower Development and Training
United States Department of Health, Education and Welfare

and

Bureau of Mines
United States Department of Interior

by the

DEPARTMENT OF MINERAL ENGINEERING

JANUARY 5 , 1973

VT020134

THE PENNSYLVANIA STATE UNIVERSITY
118 MINERAL INDUSTRIES BUILDING
UNIVERSITY PARK, PENNSYLVANIA 16802

College of Earth and Mineral Sciences
Department of Mineral Engineering

Area Code 814
865-3437

January 3, 1973

Dr. Howard A. Mathews, Director
Division of Manpower Development and Training
U. S. Department of Health, Education and Welfare
Washington, D. C. 20240

Dear Dr. Mathews:

Penn State's Department of Mineral Engineering is pleased to submit the attached final report in connection with Training Project No. P44804, "Integrated Surface Mining and Reclamation Techniques." The purpose of this project was to develop a pilot curriculum for training bituminous coal surface mine personnel in the problems of work, health and safety, environmental control, productivity, and economics.

The curriculum developed in this project is divided into forty-five units covering all aspects of coal strip mining. We paid particularly close attention to the problems of the small operators. In fact, the strip mine industry in Western Maryland was used as a data source for the project. The course can, however, be used in any state practicing bituminous coal strip mining in this country. It is our recommendation that Western Maryland should be one of the pilot areas for the course.

We feel that adequate training of all levels of personnel is one of the main ways to advance technology, improve economics, obtain better health and safety records, and decrease environmental problems of surface mining. It is our intention to submit a proposal to conduct this course on a pilot basis.

We greatly appreciate the opportunity of working on this project and look forward to increased activity in the training area.

Sincerely yours,

Thomas V. Falkie

Thomas V. Falkie, Head
Department of Mineral Engineering

HBCharmbury

H. B. Charmbury, Assistant Dean
for Planning and Development

eg

Attachment

cc: Dr. Elburt F. Osborn, Director
Bureau of Mines
U. S. Department of the Interior

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EDUCATION & WELFARE
OFFICE OF EDUCATION
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THE PENNSYLVANIA STATE UNIVERSITY
COLLEGE OF EARTH AND MINERAL SCIENCES
UNIVERSITY PARK, PENNSYLVANIA

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ACKNOWLEDGMENTS

The Department of Mineral Engineering in the College of Earth and Mineral Sciences at the University expresses its sincere appreciation to the Division of Manpower Development and Training under Director, Dr. Howard A. Mathews in the U.S. Department of Health, Education and Welfare for providing the funds to make this project possible.

We also appreciate the deep interest and efforts made by the Division of Education and Training, and the Division of Environment in the U. S. Bureau of Mines in promoting the project. We are particularly grateful to the Bureau's Liaison Officer for the States of Pennsylvania, Maryland, New Jersey, and Delaware for his coordination in bringing all parties concerned together so that the project could be conducted in complete harmony.

The complete cooperation of the Division of Vocational Education in the Pennsylvania Department of Education and of the Bureau of Mines in the Department of Natural Resources for the State of Maryland is also acknowledged.

The criticisms and comments of the following persons who served as an Advisory Committee to guide the progress of the project was of great help to the staff:

J. Bates Johnson, Manpower Development Specialist
Division of Manpower Development and Training
Department of Health, Education and Welfare

James McGoye, Acting Chief, Cooperative Training
Division of Education and Training
U. S. Bureau of Mines

James E. Gilley, Staff Assistant
Division of Environment
U. S. Bureau of Mines

Mazie B. Mohney, Consultant to the Director
U. S. Bureau of Mines

Ronald D. Hill, Chief
Mine Drainage Pollution Control Activities
Environmental Protection Agency

Harry B. Buckley, Director
Maryland Bureau of Mines

Arnold H. Harvey, Liaison Officer
U. S. Bureau of Mines, and
Chairman of the Advisory Committee

The following members of the Mineral Engineering Staff served as project personnel and provided the expertise in their specific fields:

Thomas V. Falkie, Head, Department of Mineral Engineering
H. B. Charmbury, Assistant Dean for Planning and Development
Robert Stefanko, Assistant Dean for Continuing Education
Robert B. Hewes, Professor of Mining Engineering
Joseph W. Hunt, Professor of Mining Engineering
Harold L. Lovell, Director of Mine Drainage Research
Lee W. Saperstein, Associate Professor of Mining Engineering
Charles B. Manula, Associate Professor of Mining Engineering
Lloyd A. Morley, Assistant Professor of Mining Engineering
R. Venkataramani, Assistant Professor of Mining Engineering
Grant R. Brown, Research Assistant in Mining Engineering
Eileen E. Grimes, Secretary to the Assistant Dean for Planning and Development

PREAMBLE

Mining, like agriculture, is a basic industry in our mineral-dependent civilization. The mining industry is now undergoing a revolution, the implications of which are not yet fully determined. What this "revolution" amounts to is that it is no longer possible to plan, design, build and operate mining operations by "seat of the pants" technology or "back of the envelope" economics. Mines are becoming increasingly complex and more mechanized and automated, and they require all of the available tools of modern technology and management. There are reasons for this: first, there is some indication of a decline in manpower productivity, leading to increased costs at a time when mineral demand is at an all-time high and rising; second, there are vigorous internal and external efforts to improve mining's health and safety record; third, there is increased activity to control and correct environmental disturbances caused by mining; and fourth, mineral deposits are becoming leaner and more difficult to mine. To cope with these problems we need to develop new technology and, as more specifically related to this proposal, to update the knowledge of mine operators and workers in the existing technology and management methods.

Small mine operators have been especially hurt by the advent of tough new legislation on health and safety and environmental protection. By "small operators" we mean those whose modest financial resources preclude the hiring of adequate engineering and technical personnel or prevent them from investing large sums of capital for overcoming the problems mentioned above. A typical example of this would be the coal strip mine operators in Maryland. There is the belief that these operators and their personnel would benefit tremendously by a comprehensive training course covering all phases of design, planning, management, laws and regulations, reclamation procedures, health and safety procedures, economics, etc.

This is a curriculum outline of such a training course for bituminous coal strip mining personnel. It is designed to assist the owners, managers, supervisory people, and labor force to conduct their strip mining operations more economically, with good health and safety practices, and with the proper reclamation and restoration of the stripped land.

The course based on this outline may be taught in any state practicing bituminous coal strip mining in this country. However, the details in the outline are prepared for an initial presentation of the course in the State of Maryland, which is intended to be a pilot program for this type of course. If the course is taught in another state, certain adjustments will have to be made, based upon the organization and laws of the state.

Basically, the course covers the economics of strip mining, the mandatory health and safety standards, the federal and state strip mining laws, the various strip mining unit operations and the various methods of restoring the land to useful, productive, and economical purposes.

It will be necessary for an organization to be responsible for the conductance of the course. This organization will have to work closely with the proper state personnel in which the course is to be taught and under the direction of the advisory committee which supervised the preparation of the curriculum outline.

The organization will have to determine the location and time for teaching the course. There are forty-five one-hour units. This means the course could be taught one hour a night a week for forty-five weeks or it could be taught three hours a night five nights a week for three weeks. These are the extremes and are not recommended. It is recommended based upon good educational practices and practical experiences with this type of course that it be taught either three hours a night one night a week for fifteen weeks, or two hours a night two nights a week for ten weeks with the last night being a three-hour session.

The organization responsible for presenting the course will also have to select the instructors to teach the individual units. If the course is given in two or three-hour sessions at a time, it is recommended that one instructor be responsible for the series of units to be presented in a single night. The instructors will have to be very carefully selected by the organization in cooperation with the appropriate state officials and each instructor should be approved by the advisory committee. It is essential that the instructors be completely familiar with the subject material and have expertise in their fields. For practical reasons, it is likely that the instructor may want to rearrange the suggested outline. He should have this freedom. It is suggested that the instructor read the purpose of each unit and then study very carefully the references available for each unit before using the suggested unit outline or preparing his own. However, if the instructor prepares his own unit, it is essential that as a minimum all subjects in the current outline be covered.

Recent federal regulations require that certain strip mine personnel be certified by state or federal regulatory agencies.

However, to date no detailed rules have been established to govern the certification procedure. It is believed that this course will be beneficial to those who are planning to take certification examinations. It may be necessary to make modifications or extensions to the course, depending upon the nature of these examinations. It is recommended that persons who successfully complete this course be given partial credit toward certification.

Finally, it is recognized that social, political, and technological changes occur quite rapidly in the field of bituminous coal strip mining. Therefore, it is most important that the organization responsible for the course be up to date on all phases of the field and that the organization supply the instructors with the latest references relative to the various subjects. The basic principles will never change, but the specifics in a given subject will change and will be dependent upon the locality in which the course is taught.

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UNIT #1

TITLE: General Economics of the Coal-Energy Markets and the Place of Surface Mining

PURPOSE: To acquaint participants with the supply-demand situation for energy and coal; to discuss the status and future of coal; to focus on problem areas that can affect the economics of strip mining.

OUTLINE:

I. Surface Mining

A. Extent of surface mining

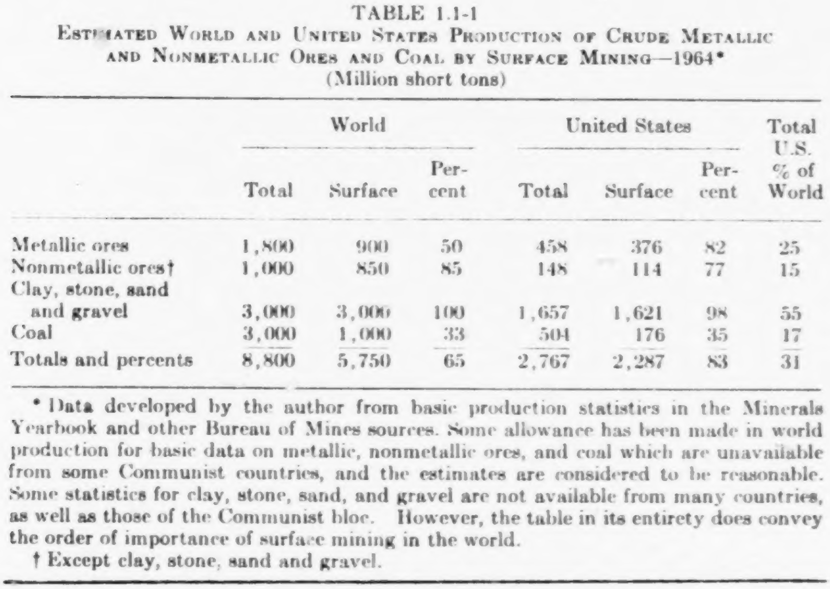


TABLE 1.1-1
ESTIMATED WORLD AND UNITED STATES PRODUCTION OF CRUDE METALLIC AND NONMETALLIC ORES AND COAL BY SURFACE MINING—1964*
(Million short tons)

	World			United States			Total U.S. % of World
	Total	Surface	Percent	Total	Surface	Percent	
Metallic ores	1,800	900	50	458	376	82	25
Nonmetallic ores†	1,000	850	85	148	114	77	15
Clay, stone, sand and gravel	3,000	3,000	100	1,657	1,621	98	55
Coal	3,000	1,000	33	504	176	35	17
Totals and percents	8,800	5,750	65	2,767	2,287	83	31

* Data developed by the author from basic production statistics in the Minerals Yearbook and other Bureau of Mines sources. Some allowance has been made in world production for basic data on metallic, nonmetallic ores, and coal which are unavailable from some Communist countries, and the estimates are considered to be reasonable. Some statistics for clay, stone, sand, and gravel are not available from many countries, as well as those of the Communist bloc. However, the table in its entirety does convey the order of importance of surface mining in the world.

† Except clay, stone, sand and gravel.

SOURCE: Reference 8

B. Technological trends

1. Rotary drilling: Shift from drum drills, also trend to larger diameters (up to 15 inches)

2. Introduction of

    a. Fertilizer grade ammonium-nitrate-fuel oil explosives
    b. Water-gell slurry explosives
    c. Field-mixed explosives

3. Shift to truck haulage (maximum 200 tons)

UNIT #1 continued

4. Increasing capacity of trucks and excavating equipment

    a. Maximum dragline = 220 yards^3
    b. Maximum shovel = 185 yards^3

5. Introduction of many auxiliary, labor-saving devices

6. Innovations in mineral beneficiation

7. Crushing station in pits, then to conveyors (in open-pit mining)

II. Coal and Energy Production and Markets

A. Gee-Whiz numbers

1. World energy requirements can be expected to increase from about 7,000 million tons of coal equivalent in 1970 to about 12,000 million in 1980, and thereafter to double again by the year 2000.

    a. In order to cover this immense energy requirement, it will be necessary not only to exploit existing sources rationally and economically, but also to make considerable efforts to develop new processes for energy production. These will include vigorous efforts to solve the water and air pollution problems connected with the use of energy.

    b. Out of this world energy consumption of 7,000 million tons of coal equivalent in 1970, three-sevenths, or not quite half, was accounted for by the United States of America and the Western European Community jointly, the U.S.A. taking two-sevenths and the Community one-seventh.

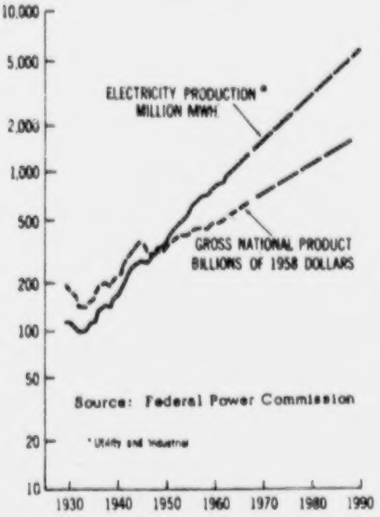
2. Our energy systems are approaching a critical time--the demand for energy in the future is going to continue at a rapidly increasing rate. Our projected requirements between now and the turn of the century are staggering. During this 30-year period from our finite resources

    a. We will need 1,000 trillion cubic feet of gas.
    b. We will need 250 billion barrels of oil.
    c. We will need 25 billion tons of coal.
    d. We will need 1.4 million tons of uranium.

UNIT #1 continued

3. By the year 2000, annual U. S. energy demand will have soared to almost triple our current requirement. As our population and technology escalate, so do our energy requirements and so, too, do our environmental concerns.

4. Energy consumption rate exceeds growth rate of gross national product.



GROWTH OF ELECTRICITY PRODUCTION AND GROSS NATIONAL PRODUCT
1929 - 1990

Source: Federal Power Commission

* Utility and Industrial

SOURCE: Reference 9

UNIT #1 continued

5. Projected gross consumption of energy in the U. S.

PROJECTED GROSS CONSUMPTION OF ENERGY
IN THE UNITED STATES, 1980 and 1990
(Quadrillion Btu)

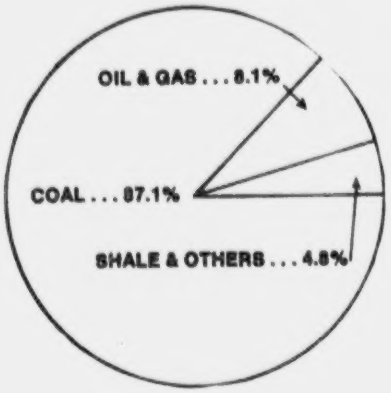
	1971 (preliminary)		Projected			
			1980		1990	
Energy Source	Amount	% of Total	Amount	% of Total	Amount	% of Total
Coal 1/	12.6	18.3	18.0	18.9	18.5	13.2
Gas 2/	22.7	32.9	26.5	27.9	35.7	25.5
Oil	30.5	44.2	38.0	40.0	50.0	35.7
Hydro	2.8	4.0	3.0	3.2	3.6	2.6
Nuclear	0.4	0.6	9.5	10.0	32.2	23.0
Total	69.0	100.0	95.0	100.0	140.0	100.0

[1] Anthracite, bituminous and lignite.

[2] Future Requirements Committee of the gas industry estimates gas requirements of 38.5 in 1980 and 50.1 in 1990. Source: Bureau of Mines news release, Mar. 31, 1972, and Information Circular 8384.

SOURCE: Reference 9

6. Mineral-fuel reserves in the U. S.



SOURCE: Reference 5

UNIT #1 continued

B. In 1970

1. 46.4 Percent of electric utility energy came from coal and 24.2 percent of total energy.

2. Coal was used as follows.

	In Millions of Tons			
	Utilities	Other	Total	Percent
Deep mining	133.3	205.4	338.7	56
Surface mining	198.0	66.1	264.1	44
Total	331.3	271.5	602.8	100

SOURCE: Reference 2

3. In other words, a significant amount of the nation's energy comes from surface-mined coal.

C. Coal mining in the State of Maryland

1. Tonnage (000 tons)

					Output per Man-Day			
Year	Total	U.G.	Strip	Auger	Total	U.G.	Strip	Auger
1966	1,222	429	772	21	16.17	10.47	23.02	19.99
1967	1,306	381	880	45	18.51	11.27	25.11	27.90
1968	1,447	354	994	99	20.92	12.02	26.81	37.27
1969	1,367	322	962	83	20.88	11.03	29.09	20.67
1970	1,615	238	1,266	111	22.53	12.03	25.56	43.87
1971	1,592	179	1,310	103				

SOURCE: Reference 2

2. Number of active mines (Ref. 2)
3. Employment (Ref. 2)
4. Safety data (Ref. 2)

III. Problems Affecting Future of Coal

A. Public policy (National Energy Policy)

UNIT #1 continued

B. Physical character of future mineral reserves (Ore bodies and coal deposits are becoming leaner and more difficult to mine economically.)

C. Productivity (evidence of recent decline, especially in underground mining)

D. Labor relations

E. Health and safety considerations

F. Environmental aspects

   1. SO_2 and other air problems (Note: Elaborate on the SO_2 problem as it relates to today's market, balance of payments, etc.)

   2. Water effluent control

   3. Land reclamation laws

IV. Solutions

A. More training and education at all levels

   1. Unskilled
   2. Skilled
   3. Salaried
   4. Professional

B. Greater percentage of skilled and technical people; greater ratio of skilled and technical to dollars invested.

C. No longer possible to plan, design, build and operate mining operations by "seat of the pants." Mining operations are complex systems that require engineered approach.

D. No longer possible to use "back of the envelope" economics. Better capital expenditure and cost control procedures must be implemented.

E. Enlightened management approaches, stressing "human side," are required.

F. Better technology, thus more research, is needed.

UNIT #1 continued

REFERENCES:

1. Anonymous. Minerals Yearbook, Volumes 1-3, Bureau of Mines, U. S. Department of the Interior, Washington, D. C., Annual.

*2. Anonymous. Bituminous Coal Data, National Coal Association, Washington, D. C. (1971).

*3. Anonymous. Outlook for Energy in the United States to 1985, Energy Economics Division, The Chase Manhattan Bank, New York (June 1972).

*4. Anonymous. Map of Coal Areas in United States, National Coal Association.

*5. Anonymous. "Coal--Indispensable Energy Resource for the Future," 1971 Keystone Coal Industry Manual, McGraw-Hill, Inc., New York.

*6. Anonymous. What Mining Means to the United States, American Mining Congress, Washington, D. C. (1972).

*7. Anonymous. Impact of Surface-Mined Bituminous Coal and Lignite on United States Energy Sector, National Coal Association (1972).

8. Pfleider, E. P. Surface Mining, AIME, New York (1968).

*9. Anonymous. Energy and Public Policy, Special Situation Report Number 2 on the Energy Crisis, American Mining Congress (May 1972).

10. Anonymous. "Muddling Through the Energy Crisis," Mining Engineering (October 1972).

*Possible handouts.

UNIT #2

TITLE: Geology of Coal Bearing Strata

PURPOSE: To explain variations in coal seams and associated strata and differences between various seams.

OUTLINE:

I. Origin and Formation of Coal and Associated Strata

   A. Classes of rocks

      1. Igneous
      2. Sedimentary
      3. Metamorphic

   B. Coal as a sedimentary rock
   C. Formation and extent of sedimentary rocks (Cover most of the earth--25,000 feet thick in Appalachia)

II. Movements of the Earth's Crust (Emphasize that it is still active today; just changes location and tempo)

   A. Rising and sinking
   B. Movement of seas
   C. Stratification
   D. Rationalize multiple movements by comparative dimensions
   E. Deposition of material

III. Associated Strata

   A. Examples and origin of sedimentary rocks

      1. Limestone
      2. Sandstone
      3. Clay
      4. Shale, etc.

   B. Bedding planes (major and minor)
   C. Evidence of earth's crust movements (yo-yo action)

IV. Conditions for Coal Formation

   A. Visual evidence (thin sections) of coal's vegetal origin
   B. Prevention of complete decay (sinking swamps--stagnant water)
   C. Heavy vegetation--rapid growth (high CO_2 content--greenhouse effect)

UNIT #2 continued

D. 30 feet spongy peat = 3 feet compressed peat = 1 foot bituminous coal (approximately 300 years for generation of original material--not transformation to coal)

REFERENCES:

1. Jones, D. and J. W. Hunt. Coal Mining, Volume I, Continuing Education Stores, The Pennsylvania State University, University Park, Pennsylvania (1950).

2. Anonymous. Keystone Coal Industry Manual, McGraw-Hill, Inc., New York, May of each year.

UNIT #3

TITLE: Constitution, Classification and Utilization of Bituminous Coal

PURPOSE: To acquaint the mining industry with the differences between various coals according to their constitution, and the markets available based on these differences.

OUTLINE:

I. Constitution of Coal--Proximate Analysis (Emphasize system desirability)

   A. Proximate constituents

      1. Moisture
      2. Volatile matter
      3. Fixed carbon
      4. Ash

   B. Describe analytical procedures and significances of each determination
   C. Other determinations and their importance

      1. Sulphur
      2. Ash softening temperature
      3. Coking characteristics
      4. Grindability
      5. B.T.U.

   D. Discuss distillation and coking
   E. How coal is marketed (B.T.U. content)

II. Coal Classification

   A. Anthracite, bituminous, subbituminous, lignite
   B. Limits and characteristics
   C. Uses by rank

III. How Coal is Cleaned

   A. Crush, screen, separate
   B. Middlings cut
   C. Problems in cleaning

      1. Black jack
      2. Fusain
      3. Sulphur

   D. Range of reject percentage
   E. Coal flotation

UNIT #3 continued

IV. Coal Seams of the Local Area

  A. What they are--how they lie
  B. Appalachian geosyncline

V. United States Reserve--Extent

  A. 95 percent of U. S. production are east of the Mississippi River
  B. 75 percent of U. S. low-sulphur reserves are west of the Mississippi River
  C. Future trends

REFERENCES:

1. Anonymous. A.S.T.M. Standards on Gaseous Fuels, Coal and Coke, American Society for Testing of Materials, 1916 Race Street, Philadelphia, Pennsylvania (1972).

2. Anonymous. Coal Resources of the United States, Geologic Survey Bulletin #1275, U. S. Department of the Interior, Washington, D. C.

UNITS #4-5

TITLE: Managerial Economics and Management of Strip Mining Operations

PURPOSE: To review general concepts and approaches of management; to discuss fundamentals of managerial economics in terms of capital and operating cost control

OUTLINE:

I. Review of General Concepts of Management

  A. Managerial functions (administrative skills required)

    1. Planning
    2. Organizing
    3. Motivating
    4. Directing
    5. Controlling

  B. Business functions (technical knowledge and skills required)

    1. Financial management
    2. Sales
    3. Planning
    4. Personnel
    5. Research and development
    6. Purchasing
    7. Engineering
    8. Production
    9. Facilities

      a. Buildings
      b. Space
      c. Equipment

    10. Maintenance
    11. Administrative management

  C. Key management concepts

    1. Job enrichment
    2. Management by objectives
    3. Situational theory of management
    4. The Managerial Grid
    5. Sensitivity training (T-groups)
    6. Selective leadership
    7. Management by exception
    8. Maslow's Hierarchy of Needs
    9. Herzberg's Motivator/Hygiene Factor Concept

UNITS #4-5 continued

10. Theory X, theory Y
11. Participative management
12. Scientific management

D. Principles of organization

1. Objectives: The objectives of the enterprise and its component elements should be clearly defined and stated in writing. The organization should be kept simple and flexible.

2. Activities and grouping of activities

   a. The responsibilities assigned to a position should be confined as far as possible to the performance of a single leading function.

   b. Functions should be assigned to organizational units on the basis of homogeneity of objective to achieve most efficient and economic operation.

3. Authority

   a. There should be clear lines of authority running from the top to the bottom of the organization, and accountability from bottom to top.

   b. The responsibility and authority of each position should be clearly defined in writing.

   c. Accountability should always be coupled with corresponding authority.

   d. Authority to take or initiate action should be delegated as close to the scene of action as possible.

   e. The number of levels of authority should be kept to a minimum.

4. Relationships

   a. There is a limit to the number of positions that can be effectively supervised by a single individual.

UNITS #4-5 continued

- b. Everyone in the organization should report to only one supervisor.
- c. The accountability of higher authority for the acts of its subordinates is absolute.

II. Managerial Economics

- A. Decision making in the firm
  1. When to spend money
  2. How to run operations
  3. When to make changes
  4. Cost reduction expenditures versus income expansion expenditures
  5. Organization and systems
  6. Total delivered cost concept
- B. Fundamental model for decision making
  1. Profit and loss statement

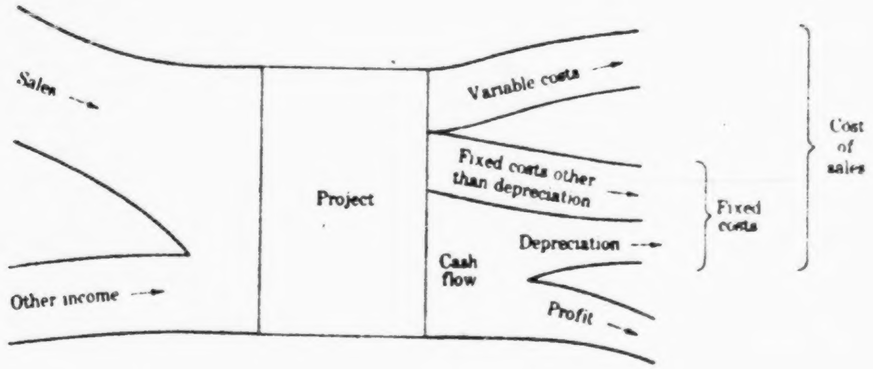
a.	Sales	$XXX,XXX
b.	Cost of sales	XXX,XXX
c.	Gross profit	XXX,XXX
d.	Income tax	XXX,XXX
e.	Net profit	$XXX,XXX

  2. Where do profits go
     - a. Dividends
     - b. Reinvestment in company
       - 1) Plowback capital
         - a) Expansion capital
         - b) Sustaining capital
       - 2) Diversification capital
     - c. Pay debts
     - d. Savings account
- C. Criteria for decision making
  1. Net profit
  2. Cash flow

UNITS #4-5 continued

3. Payback time
4. Annual cost
5. Percent profit on investment, equity
6. Unit cost to produce
7. Percent profit on sales
8. Unit cost to produce and sell
9. Present value of any of above

D. Cash flow


Sales
Other income
Project
Variable costs
Fixed costs other than depreciation
Depreciation
Cash flow
Profit
Fixed costs
Cost of sales

E. Depreciation

1. Definition
2. Some firms maintain two systems
3. Factors producing capital consumption/retirement of assets
4. Methods of depreciation

F. Depletion

1. Percentage depletion
2. Cost depletion
3. Example

G. Taxes

1. Corporate taxes
2. Capital gains or losses

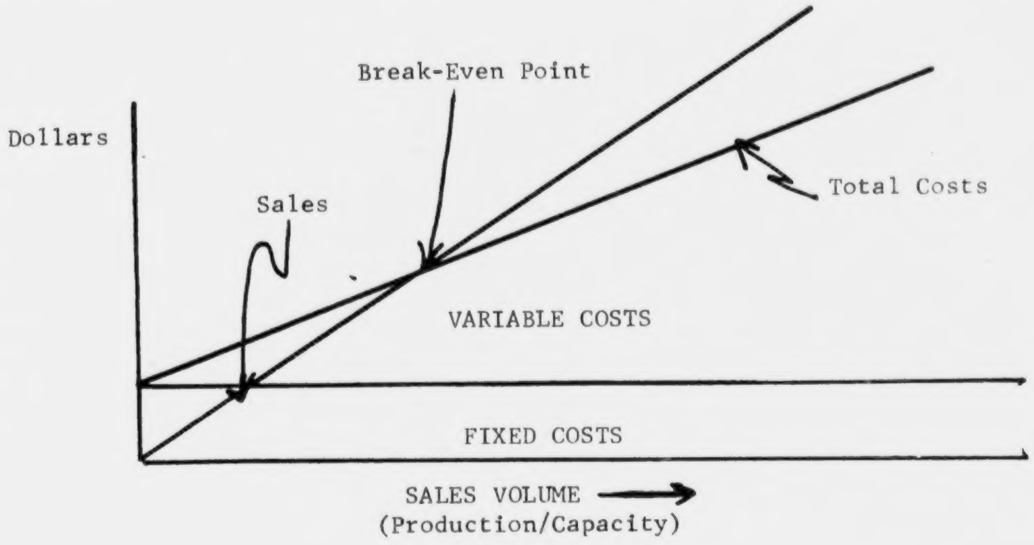
H. Capitalization versus expense

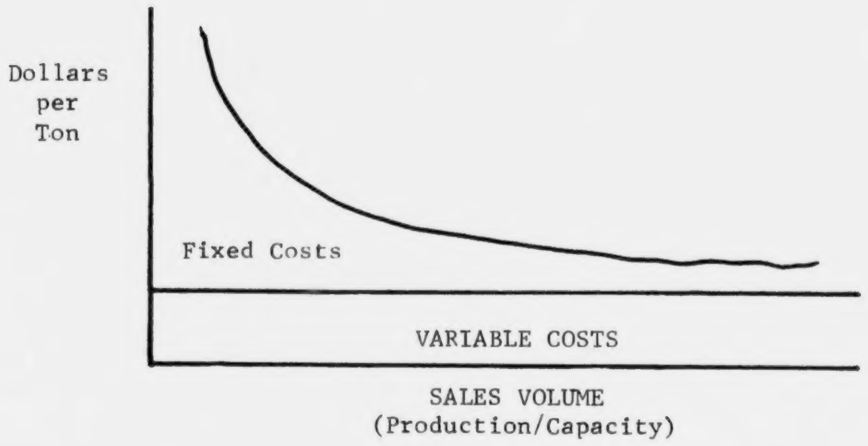
I. Accounting system

1. Profit planning (actual versus budget = variance)
2. Cost elements (See diagram on next page)
    a. Controllable versus noncontrollable
    b. Fixed versus variable

UNITS #4-5 continued

FIXED VERSUS VARIABLE COSTS





UNITS #4-5 continued

3. Break even analysis
4. Fixed capital
5. Working capital
6. Cost centers

J. Principles

1. The "bigger the better principle" (Other things being equal, bigger benefits are preferable to smaller ones.)

2. The "bird in the hand principle" (Other things being equal, early benefits are preferable to later benefits.)

3. Time value of money concept--A dollar today is worth more than a dollar next year. (Show simple interest example.)

K. Return on investment

1. Fallacies, pitfalls, faulty practices
2. Payback
3. Return on investments and modifications
4. Discounted cash flow and modifications
5. Characteristics of a good method
6. Examples

L. Equipment economics

1. Cost estimation
2. Replacement

REFERENCES:

*1. Levy, A. H. "New Developments in Management," The Journal of Industrial Engineering, Volume 26, Number 3 (May-June 1965).

2. Uris, Auren. "Key Management Concepts," (Chapter 3) The Executive Deskbook, Van Nostrand Reinhold Company, New York (1970).

3. Anonymous. "Money in Mining," Series of articles about financing mines, Engineering and Mining Journal (December 1970).

*4. Falkie. T. V. "Trends in Mineral Industry Management," Earth and Mineral Sciences, Volume 41, Number 4, The Pennsylvania State University (January 1972).

UNITS #4-5 continued

5. Various programmed teaching courses, short courses, and publications on all phases of management, American Management Association, 135 West 50th Street, New York, New York 10020.

6. Pfleider, E. P., Editor. Surface Mining, AIME, New York (1968).

7. Nichols, H. L. Moving the Earth, Second Edition, North-castle Books, Greenwich, Connecticut (1962).

*8. Falkie, T. V. "Economic Alternatives," Presented to Management-Engineering Conference, AIME, Tampa, Florida (March 1965).

9. Various popular books on management: The Peter Principle, Parkinson's Law, Up the Organization, etc.

*Suggested handouts

UNITS #6-7

TITLE: Mandatory Health and Safety Standards for Surface Coal Mines

PURPOSE: To provide a general and administrative understanding of the rules and regulations in force pertaining to the health and safety of persons working in and about surface coal mines, as this is listed in current federal and state regulations.

OUTLINE:

I. Health

   A. Application and administration

      1. Scope
      2. Definitions
      3. Programs

   B. Dust standards

      1. Maximum allowable concentrations
      2. Measurement and approved instruments
      3. Sampling cycles and related schedules

   C. Airborne contaminants

      1. Inhalation hazards
      2. Limits
      3. General sampling requirements
      4. Detection and approved instruments

   D. Noise standards

      1. Limits
      2. Measurement and approved instruments

   E. Sanitary facilities and drinking water

      1. General requirements
      2. Location
      3. Drinking water

         a. Quality
         b. Distribution
         c. Dispensing

II. Safety

   A. Application and administration

UNITS #6-7 continued

   1. Scope
   2. Definitions

- B. Qualification and certification
   1. Requirements
   2. Legal examination
      - a. Methane deficiency
      - b. Oxygen deficiency
   3. Inspection, testing and maintenance of electrical equipment
   4. Training programs

- C. Surface installations
   1. General
   2. Ventilation
      - a. Air contaminants
      - b. Measurement
   3. Illumination
   4. Storage of materials
   5. Hoisting
   6. Stockpiling and reclaiming
      - a. General
      - b. Ventilation
      - c. Escapeways
   7. Refuse piles
      - a. General
      - b. Construction
      - c. Inspection

- D. Thermal dryers
   1. General
   2. Safety equipment
   3. Location and installation
   4. Fire protection
   5. Control stations
   6. Alarm devices
   7. Examination and inspection

- E. Mechanical equipment

UNITS #6-7 continued

1. Mobile and stationary machines
    a. Guards
    b. Protective devices
    c. Canopies
2. Drive belts and pulleys
3. Welding operations
4. Compressed air and boilers

F. Installation and maintenance of electrical equipment

1. Qualified person
2. Examination and testing
    a. Conductors
    b. Splices
    c. Protective devices
    d. Transformers
    e. Wiring
    f. Connectors
3. Trailing cables
    a. Temporary and permanent splices
    b. Protective and disconnecting devices
    c. Handling
4. Grounding
    a. Approved methods
    b. Repairs
    c. Protective equipment
5. High voltage distribution
    a. Circuits
    b. Grounding
    c. Testing and examination
    d. Approvals
6. Movement of equipment
7. Portable substations and transformers
8. Low and medium AC voltage
    a. Circuits
    b. Grounding
    c. Testing and examination
    d. Approvals

UNITS #6-7 continued

9. Trolley wires

G. Ground control

    1. Ground control plan

        a. Highwall
        b. Pit
        c. Spoil

    2. Inspection and maintenance
    3. Sealing
    4. Drilling

        a. General safeguards
        b. Operation
        c. Jackhammers
        d. Airdrills

H. Fire protection

    1. Training and organization
    2. Escape plans
    3. Warning signs

        a. Open flame
        b. Storage

    4. Internal combustion engines
    5. Battery-charging stations
    6. Belt conveyors
    7. Firefighting equipment

        a. Requirements
        b. Quantity and location

    8. Examination and maintenance
    9. Welding and cutting

I. Mine maps

    1. Requirements
    2. Certification

J. Explosives and blasting

    1. Surface magazines
    2. Transportation

UNITS #6-7 continued

        - a. Vehicles
        - b. Detonators
        - c. Explosives

    - 3. Handling

        - a. Authorized persons
        - b. Requirements

    - 4. Blasting agents

- K. Man hoisting

    - 1. Elevators
    - 2. Automatic controls and brakes
    - 3. Ropes and cables
    - 4. Inspection and maintenance

- L. Auger mining--planning and inspection

    - 1. Restrictions
    - 2. Operation
    - 3. Protective devices
    - 4. Procedure
    - 5. Abandonment

- M. Loading and haulage

    - 1. General
    - 2. Aerial tramways
    - 3. Trains and locomotives
    - 4. Mobile equipment

- N. Miscellaneous

    - 1. Communications (emergency
    - 2. Medical assistance (transportation)
    - 3. First Aid

        - a. Training
        - b. Personnel
        - c. Programs
        - d. Equipment

    - 4. Safety training (program)
    - 5. Protective clothing
    - 6. Smoking
    - 7. Reopening mines

        - a. Notification
        - b. Inspection

UNITS #6-7 continued

    8. Daily inspection

        a. Certified person
        b. reports

O. Slope and shaft sinking

    1. Plans
    2. Approvals
    3. Inspections

        a. Hazards
        b. Reports

    4. Drilling and mucking
    5. Diesel powered equipment
    6. Hoists and hoisting

        a. Communications
        b. Inspections
        c. Installations
        d. Qualified persons

    7. Explosives and blasting
    8. Ventilation
    9. Ladders and stairways
    10. Fire resistant materials

REFERENCES:

1. Federal Register, Title 30, Mineral Resources, Part 71--Mandatory Health Standards--Surface Work Areas of Underground Coal Mines and Surface Coal Mines, U. S. Bureau of Mines, Department of the Interior, Washington, D. C. (March 28, 1972).

2. Federal Register, Title 30, Mineral Resources, Part 77--Mandatory Safety Standards--Surface Coal Mines and Surface Work Areas of Underground Coal Mines, U. S. Bureau of Mines, Department of the Interior, Washington, D. C. (May 22, 1971).

3. Annotated Code of Maryland, Regulation No. 1, Sections 492 and 659, Article 66C, Bureau of Mines, Maryland Geological Survey (June 24, 1970).

UNIT #8

TITLE: Mine Gases

PURPOSE: To provide mining personnel with a knowledge of the requirements and methods employed in measuring and controlling explosive and toxic gases as these are found in the operation of surface coal mines.

OUTLINE:

- I. Introduction
  - A. Human respiration
  - B. Oxygen depletion
  - C. Mine gases
    - 1. Characteristics
    - 2. Source
    - 3. Detection
    - 4. Threshold limit
    - 5. Fatal point
- II. Gas Sampling--Safety Lamp, Methane Detector, Nitrogen Dioxide Detector, Carbon Monoxide Detector
  - A. Description
  - B. Maintenance
  - C. Application
  - D. Limitations
- III. Control of Mine Gases
  - A. Strata gas (ventilation)
  - B. Blasting gas
    - 1. Prevention
    - 2. Reduction
    - 3. Removal
    - 4. Absorption
  - C. Engine exhaust gases
    - 1. Production
    - 2. Absorption
    - 3. Detection
  - D. Fires and explosions (battery gas)

UNIT #8 continued

REFERENCES:

1. Hartman, H. L. Mine Ventilation and Air Conditioning, The Ronald Press Company, New York (1961).

2. Zabetakis, M. G., R. W. Stahl, H. A. Watson. Determining the Explosibility of Mine Atmospheres, IC7901, U. S. Bureau of Mines, Department of the Interior, Washington, D. C. (1959).

3. Anonymous. Introduction to Courses in Oxygen Deficiency and Methane Detecting Devices, Division of Education, U. S. Bureau of Mines (1971).

4. Anonymous. Permissible Flame Safety Lamp, Division of Education and Training Services, U. S. Bureau of Mines (1971).

5. Anonymous. Permissible Methane Indicating Detector, Division of Education and Training, U. S. Bureau of Mines, (1971).

6. Anonymous. Carbon Monoxide Tester, Division of Education and Training, U. S. Bureau of Mines (1971).

7. Anonymous. MSA Nitrogen Dioxide Detector, Division of Education and Training, U. S. Bureau of Mines (1971).

8. Anonymous. Mine Gases, Industrial Branch of the National Coal Board, Printed by W. S. Cowell Ltd., 8 Butler Market, Ipswich, England.

UNIT #9

TITLE: Mine Dust

PURPOSE: To provide mining personnel with a knowledge of the requirements and methods employed in measuring and controlling respirable dust conditions in surface coal mining operations.

OUTLINE:

I. The Nature of Pneumoconiosis

   A. The disease
   B. Respirable dust
   C. Curves and samples

II. The Law

   A. Dust standards
   B. Sampling procedure (general requirements)
   C. Approved sampling devices
   D. Dust concentration
   E. Sampling cycles and methods
   F. Reporting

III. Instrumentation for Dust Assessment

   A. MRE sampler

      1. Procedure
      2. Routine field maintenance

   B. Personal samplers

      1. Description
      2. Procedure
      3. Operation
      4. Maintenance

   C. Handling and weighting samples

      1. Mine data card
      2. Sample processing
      3. Data recording

   D. Analysis for quartz content

IV. Methods of Dust Control

   A. Respiratory equipment
   B. Sprays
   C. Foams

UNIT #9 continued

REFERENCES:

1. Anonymous. Sampling and Evaluating Respirable Coal Mine Dust, Instructors' Manual, Division of Education and Training, U. S. Bureau of Mines, Department of the Interior (March 1972).

2. Sinha, A. K. Coal Mine Dust, Measurement and Dust Short Course, Department of Mineral Engineering, College of Earth and Mineral Sciences, The Pennsylvania State University, University Park, Pennsylvania (July 1970).

3. Gooding, R. M. Proceedings of the Symposium on Respirable Coal Mine Dust, IC8458, U. S. Bureau of Mines (November 3-4, 1969).

UNIT #10

TITLE: Fire Protection

PURPOSE: To provide personnel with the basic knowledge required to prevent, control and abate mine fires as these are caused in the operation of surface coal mines.

OUTLINE:

I. Fire Hazards and Prevention

  A. General

    1. Firefighting facilities
    2. Plans
    3. Supervision

  B. Inspection
  C. Heating devices
  D. Combustible materials
  E. Spontaneous combustion
  F. Trash in strip pits
  G. Fire extinguishers
  H. Fire protection

    1. Motor trucks
    2. Heavy equipment
    3. Hoists and cranes
    4. Garages and repair shops

  I. Welding and cutting

    1. Cylinders
    2. Handling
    3. Operation
    4. Storage

  J. Petroleum products

    1. Storage
    2. Handling
    3. Dispensing

  K. Clothing

II. Flammable Gases and Liquids

  A. General (explosion hazards)

UNIT #10 continued

B. Ignition

1. Steaming
2. Inert gas
3. Natural gas

C. Sparks
D. Warning signs
E. Gasoline and lubricants

1. Fueling equipment
2. Handling petroleum solvents

F. Acetylene
G. Vapors and flammable liquids (physical and chemical properties)
H. Extinguishing agents

REFERENCES:

Literature

1. Anonymous. Manual of Accident Prevention in Construction, The Associated Contractors of America, Fifth Edition, Washington, D. C. (1958).

2. Anonymous. Know Your Fire Extinguishers and How to Use Them--The ABC's of Fire Protection, Walter Kidde & Company, Belleville, New Jersey.

3. Reference File, Fire Protection and Prevention, Occupational Safety & Health Reporter, The Bureau of National Affairs, Inc., Washington, D. C. (1972).

Movies

1. "Analysis of a Bulk Plant Fire" (25 minutes), NFPA 60 Batterywork Street, Boston 10, Massachusetts.

2. "Fighting Tank Fires" (25 minutes), NFPA.

3. "Tank Truck Fires" (15 minutes), NFPA.

4. "Your Clothing Can Burn" (13 minutes), NFPA.

5. "The First Five Minutes" (15 minutes), NFPA.

6. "Fires in Wires" (20 minutes), University of Michigan, Extension Service, Ann Arbor, Michigan.

UNITS #11-12

TITLE: Noise

PURPOSE: Demonstrated within the course material is the insidious nature of noise overexposure. The intention of this unit is to alert the mine operator to the dangers of excess noise, to the methods of measuring noise, to the calculations of compliance, and to the methods of reducing noise exposure. This information should allow the operator to work within the standards of noise compliance.

The material presented here is somewhat shorter than that presented by the Bureau of Mines for their certification courses. This unit is intended for a two-hour presentation, whereas the Bureau uses six hours (Ref. 1). If it is desired to use the present lectures for certification, then additional material on the properties of sound and the anatomy of the human ear must be presented and the course must be taught by a Bureau of Mines certified instructor. In any event, the instructor should be familiar with noise measurements (Ref. 2 & 3). It is intended that the notes included here should only be a supplement to the reference material.

(Note: Your audience must be gauged. If the concept of logarithms is too advanced, skip this portion, but continue to stress that decibels are measures of ratios and not a fixed quantity.)

OUTLINE:

I. Introduction (Ref. 4, pp. 1-2; Ref. 5, p. 4)

   A. Teach the methods of measuring noise.
   B. Give the details of those portions of the health laws which deal with noise.
   C. Demonstrate calculations of compliance.
   D. Give some methods of reducing noise levels.

II. Definitions (Ref. 4, pp. 3-10)

   A. Noise is unwanted or potentially harmful sound.

   B. The decibel is a unit of comparison and therefore has no fixed measure. To be manageable, a decibel is one-tenth of a Bel (named for Alexander Graham Bell). Strictly speaking, decibels are defined as

$$= 10 \log \frac{\text{observed value}}{\text{reference value}}$$

UNITS #11-12 continued

1. Decibels are commonly used by electrical engineers to give power ratios, in which case the reference value is in watts. For noise measurements, a decibel is defined as a ratio of the square roots of the air pressures due to the sound.

$$\text{decibel} = 10 \log \left[\frac{P_1}{P_o}\right]^2$$

Since P_o, the reference pressure, is 20 micronewtons/meter squared, (2×10^{-12} bar) the decibel can be redefined as

$$20 \log \frac{P}{.00002} \qquad \underline{\text{re}}\ 20\ \text{micronewtons/meter squared,}$$

where P is the root-mean-square sound pressure measured in Newtons per square meter.

2. The decibel illustrated (Use illustration 2-1 from Ref. 4--for all audiences.)

3. The lowest level of sound that a healthy young man can hear (called the threshold of hearing) is set at one decibel. This is comparable to the reference level of 20 $\mu N/m^2$. If the noise level of a heavy wagon drill, measured two feet from the exhaust port, is taken, it is seen to be about 115 dB. This is not 115 times the level of the threshold, but

$$115 = 20 \log \frac{P}{.00002}$$

$$\frac{P}{.00002} = \text{antilog} \frac{115}{20} = \text{antilog } 5.75 = \underline{562300}$$

(Ref. 4, p. 204, Table 1)

or the drill has 562,300 times the level of the threshold.

UNITS #11-12 continued

C. Sound pressure level is a decibel expression of the ratio of a given sound pressure to the reference.

D. Sound level (Ref. 4, p. 8; Ref. 5, p. 7) is the sound pressure level altered by frequency weighting networks. Sound has a characteristic frequency when it is a pure tone (440 cycles per second--c/s-for the musical note A), such frequencies being called low when less than 1,000 c/s, or high when over 3,000 or 4,000 c/s. Ordinary sounds are a mixture of frequencies, however. Frequencies in the range of 4,000 c/s are most damaging to the human ear. Thus, if the sound pressure level is weighted to indicate frequency content, it is called sound level. (This material will be repeated in the section on sound-level-meters.) These weightings, on a sound-level meter, are called the A, B and C scales.

E. Loudness (Ref. 4, pp. 44) is a qualitative indication of how a sound level appears to an observer.

   1. When one sound level is louder than another, this is a subjective determination.

   2. When one is higher than another, this is a quantitative determination.

III. Hearing Damage (Ref. 4, pp. 66-9)

   A. Hearing loss results from a variety of things which are listed below.

      1. Presbycusis (Ref. 4, p. 43) is the loss of hearing due to an ageing effect.

      2. Infection of the inner or middle ear can result in loss.

      3. Impact-type noises of high pressure can damage the ear, even to the extent of rupturing the eardrum.

      4. High-level noises that are neither painful nor discomforting can still cause a threshold shift.

      5. Threshold shift

UNITS #11-12 continued

a. When the nerves of the inner ear are exposed to high-level noise, they become damaged. The result of this damage is that a higher level of sound is necessary to reach the threshold of hearing. This is termed a threshold shift.

b. Nerves have a limited range of recuperation so that they can recover from a limited amount of damage. This is termed Temporary Threshold Shift and can be observed when working around noisy machinery. At the beginning of the day the machines appear noisier than at the end of the day. The machines have not changed; the observer's hearing has.

c. If the nerves are damaged severely enough, a Permanent Threshold Shift results and this is a noise-induced hearing loss.

B. Hearing loss is measured by the decibel shift in pure tones necessary to reach the threshold. If a partially-deaf person hears a 4,000 c/s tone only when it is 20 dB higher than when people with normal hearing hear it, he is said to have a 20 dB loss at 4,000 c/s.

IV. Exposure (Ref. 3--This should be distributed. Ref. 4, p. 5; Ref. 6)

A. In order to protect miners from noise-induced hearing loss as discussed above, several health laws have been passed. This portion of the unit will deal with exposure; the next will deal with measurement procedures.

1. The referenced coal mine law is substantially similar to those portions of the Walsh-Healey Public Contracts Law and the Occupational Safety and Health Law, which deal with noise.

2. Strip mine health codes incorporate underground noise standards.

B. Requirements (Ref. 3, Para. 70.501 and Table 1)

1. Continuous noise above 90 dB on the A scale measured with a slow meter response is considered as exposure that has to be guarded

against. In the first instance, guarding is achieved by limiting exposure. If noise levels become higher, then exposure times must be reduced. The rule-of-thumb that leads to Table 1 is that exposure is halved for each 5 dB increase of level. Hence, a man may be exposed for eight hours to 90 dBA (on the assumption that the remaining 16 hours of the day are sufficient recovery time for any temporary threshold shift that may have occurred over the shift), but if the noise level is increased 5 dB to 95 dBA, then the exposure is reduced to four hours (1/2 shift), and if the level is increased again to 100 dBA, then the exposure must be halved again to two hours (1/2 x 1/2 = 1/4 shift). Table 1 proceeds in this fashion to the absolute upper maximum of 115 dBA, for which maximum exposure is 15 minutes.

2. Continuous noise is considered as any noise burst which lasts over one second or any noise where interruptions are less than one second. For impulsive--impact--noises of less than one second duration, the maximum level is 140 dBA. (For the purpose of this unit, it will be considered that impact noises are not of great consequence in strip mines and will not be pursued further.)

C. Multiple noise exposure

1. When noise levels of different values are experienced in the same shift, then a combining procedure must be undertaken to determine if total exposure is within compliance. The examples in Para. 70.502 of Ref. 3 and in Ref. 5, page 15 should be used. This combining computation is written

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \ldots\ldots \frac{C_n}{T_n} \leq 1.$$

This means that the ratio of noise exposure at each level to its allowed exposure from Table 1 when added to the ratios of all other levels experienced during the shift should be one or less.

UNITS #11-12 continued

2. When noise levels are less than 90 dBA, exposure times are considered to be zero.

V. Measurement (Ref. 3, Para. 70.505; Ref. 4, Chapter 4 and Appendix VIII: Ref. 5, p. 9. It should be re-emphasized that any meter which meets the standards of Para. 70.505 is acceptable. A current list of approved manufacturers and models is available from the Bureau of Mines.) (A sound-level meter should be available for demonstration and inspection; at the end of this part--V, Measurement--the students should be invited to use the instrument.)

A. Meters and their uses

1. All sound-level meters have a basically similar construction

   a. A microphone, which should be kept clean and replaced at the first sign of damage
   b. At least two dials or switches
   c. A meter
   d. A battery container

2. All meters have an off position (often on the left-hand dial) and a battery test.

   a. Turn the meter on and check the battery. The battery strength is shown on the meter. If the needle does not come to rest in the "OK" zone, change the battery.

   b. Set the scale switch and then set the range switch (usually the right-hand one) to a value higher than you expect to find and uncover the microphone.

   c. Turn the on-off switch to the desired response, usually slow, and then turn the range switch down until the needle settles near zero.

   d. A noise level is read by adding the meter value to that of the range switch. If the range is 60 dB and the needle points to +2, then the reading is 62 dB; and the needle points to -2, then the reading is 58 dB.

B. Weighting networks (Ref. 4, p. 9; Ref. 5, p. 7): The "A," "B," and "C" scales are a simple way of determining frequency make-up of the noise.

  1. The "A"-scale most closely follows the response of the human ear and is thus used in the legal standards. In lay language, the "A" weighting does not hear less damaging frequencies (20-1,000 c/s) as well as damaging frequencies (1,000-8,000 c/s).

  2. The "C"-scale is essentially flat and hears all frequencies equally well. If a low-frequency noise is measured, the dBC level will be higher than the dBA level, whereas a noise of moderately high frequency will be nearly the same on both scales. For compliance measurements, the "A"-scale should be selected.

  3. The "B"-scale is more flat than the "A" but is seldom used.

C. Calibration (Ref. 4, p. 101; Ref. 5, p. 13)

  1. All sound-level meters should be purchased with an accompanying calibrator.

    a. These units are small, compact, and easy to use.

    b. When slipped over the microphone and turned on, they supply a noise of fixed level.

    c. If the meter battery is OK, but the needle does not come to the fixed level, then the adjustment screw should be turned.

    d. If calibration proves difficult, then a qualified person should be consulted.

  2. Calibration should be done before shift, during shift, and after shift.

D. Position (Ref. 4, p. 124 and following, Ref. 5, p. 13)

  1. The microphone should be near where the operator's ear would be, but to eliminate echoes the operator should, if possible, be absent.

2. Echoes can bounce off the observer or other nearby objects, hence the meter should be held well away from the observer's chest and from walls or ceilings.

3. The meter should be at right angles to the noise source.

E. Readings (Ref. 3, Para. 70.506)

1. Since the "slow" response is an averaging procedure, the meter should be in place sufficiently long to obtain a representative average. At least 30 seconds is needed for a reading.

2. For each noise exposure, five readings should be taken. The reported noise level is the average of the five.

3. Readings will be repeated for each different phase of the operation. In a truck, for instance, haulage and dumping would be separate phases.

F. Surveys and reports (Ref. 3, Paras. 70.507, 8 & 9): The referenced material should be presented explicitly, with time taken to demonstrate the Noise Data Report.

VI. Abatement and Noise Protection (Ref. 3, Para. 70.500): If it is determined that noise exposure is out of compliance, then the question of what to do becomes important. There are three potential solutions.

A. Reduction of noise levels (The first choice in obtaining compliance is elimination or properly, reduction, of the noise.)

1. Maintenance is critical.

a. Worn, rubbing, loose, or broken machines are louder than well-maintained ones.

b. These parts should be replaced or lubricated.

c. Existing mufflers should be in good condition.

   d. Holes in mufflers, tailpipes, etc., raise the noise level, as do ill-fitting air cleaners on diesel machinery.

   e. Missing covers, hoods, or windows and doors on trucks contribute to noise levels.

   f. No exhaust pipe should end near an operator's position.

2. If, after all maintenance is completed, the machine is too noisy, then dampening and isolation steps should be taken. At this point, a machine expert should be consulted.

   a. The intent is to enclose the noisy items (engines, compressors, etc.) in sound-dampening material, and, if this is not possible, to enclose the operator.

   b. The latter response is prevalent for cabs of earth-moving machines and overburden drills.

   c. If an earth-moving machine is being fitted with roll-over protection, the opportunity presents itself to fit noise isolation panelling.

   d. Other things that can be done are placing extra supports on large, resonating plates to dampen them; using two pieces of metal instead of one for things like chute bottoms; or using rubber or other dampening material between metal-to-metal contacts.

B. Personal protection

1. Certain ear muffs or plugs are recognized by the Bureau of Mines as acceptable.

2. These devices can lower the noise level reaching the ear by 15 to 30 dB when properly fitted. If it is impossible to lower noise levels as in A-2 above, then personal protectors should be provided to avoid violation.

3. Ear muffs are bulkier than plugs, but they have no hygienic problems.

UNITS #11-12 continued

4. Machine operators do not like personal protectors! Morale is improved if compliance is achieved by noise reduction rather than by protectors.

C. Job substitutions

1. If one man works in a noisy area and one in a quiet area, and the noisy area is out of compliance, compliance may be achieved by having them change jobs half-way through the shift.

2. This should be regarded as a stop-gap solution which is not as desirable as overall noise reduction.

D. In all cases, attempts to achieve compliance should be **done** in cooperation with the local inspector so that use can be made of the latest legal interpretations.

REFERENCES:

1. Lamonica, J. A. Bureau of Mines, U. S. Department of the Interior, Private communication.

*2. Federal Register, Volume 35, Number 238, pp. 18671 and 18683 (December 9, 1970).

*3. Federal Register, Volume 36, Number 130, p. 12739 (containing Noise Standard, Subpart F, of Mandatory Health Standards, Part 70, of Coal Mine Health and Safety Law, Subchapter O, of Bureau of Mines Section, Chapter I, of the Mineral Resources Section, Title 30, of the Code of Federal Regulations) (July 7, 1971). The material in Ref. 3 was first promulgated as Section 206, Noise Standard, of Public Law 91-173, the Federal Coal Mine Health and Safety Act of 1969.

**4. Peterson, A. P. G. and E. E. Gross, Jr. Handbook of Noise Control, General Radio Company, 300 Baker Avenue, Concord, Massachusetts, 282 pp., price: $2.00 (1967).

5. Anonymous. Primer of Plant-Noise Measurement, General Radio Company, 22 pp., free on request (1969).

6. Federal Register, Volume 37, Number 60, p. 6371 (containing: Noise Standard, Subpart D, of the Mandatory Health Standards--Surface Work Areas of Underground Coal Mines and Surface Coal Mines, Part 71, of the subchapter quoted in Ref. 3), (March 28, 1972).

NOTE: References 4 and 5 should be used. Although they are written by a company which sells measuring equipment, the textual material is comprehensive and easily understood. Because of their low cost, students should be encouraged to purchase them.

*Enclosed.

**Figure 2-1 from the book enclosed.

Proposed Rule Making

DEPARTMENT OF THE INTERIOR

Bureau of Mines

[30 CFR Part 70]

MANDATORY HEALTH STANDARDS FOR UNDERGROUND COAL MINES

Noise Standard

Notice is hereby given that in accordance with the provisions of section 206 of the Federal Coal Mine Health and Safety Act of 1969 (Public Law 91-173) and pursuant to the authority vested in the Secretary of the Interior under section 101 of the Act, it is proposed to amend Subpart F of Part 70, Subchapter O, Chapter I, Title 30, Code of Federal Regulations, as set forth below, which prescribes the maximum noise exposure levels for all underground coal mines established by the Secretary of Health, Education, and Welfare and the manner in which tests of the noise levels at each coal mine shall be conducted. In addition, it provides the minimum requirements which must be met by any person qualified to conduct noise level tests, and for the certification of such persons by the Bureau of Mines.

Interested persons may submit written comments, suggestions or objections to the Director, Bureau of Mines, Washington, D.C. 20240, no later than 30 days following publication of this notice in the FEDERAL REGISTER.

FRED J. RUSSELL,
Acting Secretary of the Interior.

DECEMBER 1, 1970.

Subpart F of Part 70 would be amended to read:

Subpart F—Noise Standard

§ 70.501 Definitions.

As used in this subpart, the term:

(a) "dBA" means sound pressure levels in decibels, as measured with the A-weighted network of a standard sound level meter using slow response;

(b) "Noise bursts" are periods of time during which the average noise level is 90 or more dBA;

(c) "Average noise level" is the mean A-weighted sound pressure level during a noise burst;

(d) An "interruption" of noise exposure occurs when the noise drops below 80 dBA for either (1) more than 5 minutes or (2) a period of time equal to at least 20 percent of the duration of the preceding noise burst;

(e) "Multiple exposures" means instances in which the daily noise exposure is composed of two or more noise bursts of different levels; and,

(f) "Qualified person" means, as the context requires, an individual deemed qualified by the Secretary and delegated by the operator to make tests and examinations required by this Act.

§ 70.502 Requirements.

Effective December 30, 1970, every operator of an underground coal mine shall maintain the noise exposure in the active workings of the mine during each shift at or below the permissible average noise levels set forth in table I of this subpart, but in no event shall any noise burst exceed 115 dBA.

Example. If a noise is recorded to be 109 dBA and occurs 15 times during an 8-hour shift, then the total cumulative time of the 15 noise bursts must not exceed 1 hour.

§ 70.503 Computation of multiple exposures.

The standard will be considered to have been violated in the case of multiple exposures unless the exposure totals less than one as computed by adding the total time of exposure at each specified level (C_1, C_2, C_3, etc.) divided by the total time of exposure permitted at that level (T_1, T_2, T_3). Thus, $\frac{C_1}{T_1}+\frac{C_2}{T_2}+\frac{C_3}{T_3}$ must total less than 1.

Example I. Seven noise bursts at 93 dBA for a total time of noise of 2 hours (120 minutes) and 35 bursts at 94 dBA for a total time of 1 hour (60 minutes).

$$\frac{\text{Total minutes of exposure at dBA level}}{\text{Total minutes at dBA permitted taking into consideration number of bursts}}$$

$$\frac{120 \text{ min.}}{360 \text{ min.}}+\frac{60 \text{ min.}}{360 \text{ min.}}=\frac{2}{6}+\frac{1}{6}=\frac{1}{2}$$

The sum of the fractions is less than one; hence the exposure for this shift would not violate the standard.

Example II. Seventy-five noise bursts at 109 dBA for a total time of noise of 1 hour and 35 bursts at 98 dBA for a total time of 3 hours.

$$\frac{60}{120}+\frac{180}{240}=\frac{1}{2}+\frac{3}{4}=1\tfrac{1}{4}$$

The sum of the fractions exceeds one; hence the exposure for this shift would exceed the standard.

§ 70.504 Noise measurements; general.

Every coal mine operator shall take accurate readings of the sound levels to which miners in the active workings of the mine are exposed during the performance of the duties to which they are normally assigned.

§ 70.505 Noise level measurements; by whom done.

The noise level measurements required by this Subpart F shall be taken by, or as directed by, a person who has met the minimum requirements set forth in § 70.505-1, and has been certified by the Director, Bureau of Mines as qualified to take noise level measurements as prescribed in this Subpart F.

§ 70.505-1 Persons qualified to measure noise levels; minimum requirements.

The following persons shall be considered qualified to take sound measurements as prescribed in this Subpart F:

(a) Any person who has been certified by the Bureau of Mines as an instructor in noise measurement training programs;

(b) Any person who has satisfactorily completed a noise training course conducted by the Bureau of Mines and has been certified by the Bureau of Mines;

(c) Any person who has satisfactorily completed a noise training course approved by the Bureau of Mines and has been certified by the Bureau of Mines as a qualified person.

§ 70.506 Certification by the Bureau of Mines.

Upon a satisfactory showing that a person has met the minimum requirements for sound level measurement set forth in § 70.505-1, the Bureau of Mines shall certify that such person has the ability and capacity to conduct tests of the noise levels in a coal mine and to report and certify the results of such tests to the Secretary and the Secretary of Health, Education, and Welfare.

§ 70.507 Noise measurement equipment.

(a) Measurements shall be taken only with instruments which are approved by the Bureau of Mines as permissible electric face equipment and which meet the operational specifications of the American National Standards Institute for General Purposes Sound Level Meters S1.4-1961.

(b) Equipment shall be set to operate with the A-weighted network and slow response and shall be acoustically calibrated in accordance with the manufacturer's instructions before and after each shift of use.

§ 70.503 Noise measurement procedures.

(a) Measurements shall be taken in locations where the sound is typical of that entering the ears of the miner whose exposure is under consideration.

(b) Measurement shall be made near the miner's head equidistant from the principal sound source as the miner.

(c) The A-scale readings shall be observed for five seconds and the average value recorded. The procedure shall be repeated until the number of readings equals or exceeds the range in decibels of the readings.

Example. If there is a fluctuation on the meter of 5 during the first observation, then five readings are required.

(d) The range and average of all the readings obtained shall be reported as

SOURCE: Reference 2

the typical sound level of the particular occupation.

(c) Where different and distinct noise levels occur at various phases of an operation, the noise measurement procedures shall be conducted for each phase.

§ 70.509 Initial sound level survey.

On or before 6 months after the effective date of these regulations, every operator shall:

(a) Conduct, in accordance with this subpart, a survey of the sound levels to which every occupation in the active workings of the mine is exposed during a production shift; and

(b) Report and certify to the Bureau of Mines, and the Department of Health, Education, and Welfare, the results of such survey using the Coal Mine Noise Data Report form, Figure 1.

§ 70.510 Periodic sound survey.

(a) At 6-month intervals following the due date of the initial sound survey, each operator shall conduct, in accordance with this subpart, periodic surveys of the sound levels to which the miners in the active workings of the mine are exposed and shall report and certify the results of such surveys to the Bureau of Mines, and the Department of Health, Education, and Welfare, using the Coal Mine Noise Data Report forms.

(b) The Secretary may exclude from the periodic surveys, those occupations which in his judgment present no health hazard due to noise exposures.

§ 70.511 Violation of standard; action required by operator.

Where miners are exposed to noise exceeding the standard, the mine operator shall:

(a) Institute promptly administrative and/or engineering controls necessary to assure compliance with the standard. Such controls may include protective devices other than those devices or systems which the Secretary or his authorized representative finds to be hazardous in such mine.

(b) Within 60 days following any violation of the noise standard, submit for approval to a joint Bureau of Mines-Health, Education, and Welfare Committee, a plan for the administration of a continuing, effective hearing conservation program to assure compliance with the standard, including provision for:

(1) Reducing environmental noise levels.

(2) Personal ear protective devices to be made available to the miners.

(3) An immediate audiogram to the miners and a periodic audiogram once each year thereafter.

FIGURE 1

COAL MINE NOISE DATA REPORT

Date ------------
Section ID No. ------
Mine ID No. ------
Miner's SSA No. ------
Occupation ------------------------------
Type of Mining:
  Development ------------------------------
  Retreat ------------------------------
Method of Mining:
  Continuous ------------------------------
  Longwall ------------------------------
  Conventional ------------------------------
  Other ------------------------------
Equipment in Operation:
  Electric ------------------------------
  Horsepower ------------------------------
  Pneumatic ------------------------------
  Other ------------------------------
Description of Equipment (make, model no., order no., etc.):

List sound level measurements for each level of exposure.
A. Sound level dBA ------ average,
  Sound level dBA ------ range.
  Number of interruptions ------.
  Cumulative exposure ------ minutes.
B. Sound level dBA ------ average.
  Sound level dBA ------ range.
  Number of interruptions ------.
  Cumulative exposure ------ minutes.
Hearing protective device used: Yes ------, No ------.
Check if section will be closed before next sampling: Yes ------, No ------.
Type and model no. of sound level meter ------------
Signature of qualified person --------------

TABLE I—PERMISSIBLE AVERAGE NOISE LEVEL IN DBA

Total exposure	Number of noise-burst exposures per 8-hour workday						
	1	3	7	15	35	75	150 or more
8 hours	90						
6 hours	91	92	93	94	94	94	94
4 hours	93	94	95	96	98	99	100
2 hours	96	98	100	103	106	109	112
1 hour	99	102	105	109	114	(115)	
30 minutes	102	106	110	114	(115)		
15 minutes	105	110	(115)				
8 minutes	108	(115)					
4 minutes	111	(115)					

Extrapolation between points in this table is permissible.

[F.R. Doc. 70-16534; Filed, Dec. 8, 1970; 8:51 a.m.]

SOURCE: Reference 2

Bureau of Mines

NOISE MEASUREMENT TRAINING PROGRAM

Tests of Noise Levels at Coal Mines; Qualified Persons

Section 206 of the Federal Coal Mine Health and Safety Act of 1969 provides in part:

> Beginning 6 months after the operative date of this title, and at intervals of at least every 6 months thereafter, the operator of each coal mine shall conduct, in a manner prescribed by the Secretary of Health, Education, and Welfare, tests by a qualified person of the noise level at the mine and report and certify the results to the Secretary and the Secretary of Health, Education, and Welfare * * *

Notice is hereby given that the Bureau of Mines will conduct periodic noise measurement training programs at the Bureau of Mines, 4800 Forbes Avenue, Pittsburgh, PA 15213, and at other locations as the need of the coal mine industry may require, in order to provide training for persons wishing to qualify to conduct tests of noise levels at underground coal mines. Applications for attendance should be directed to:

Pittsburgh Field Health Group, Bureau of Mines, 4800 Forbes Avenue, Pittsburgh, PA 15213.

The Bureau of Mines will also approve noise measurement training programs established and maintained by any operator, coal mine industry group, labor organization representing miners, or any other person where such programs are conducted by persons certified by the Bureau as qualified to conduct noise measurement training programs, and where such programs include instruction in the following subject matter:

(a) The nature and basic properties of sound;

(b) The organic structure of the human ear and the mechanics of hearing;

(c) The design, construction and use of the sound pressure level meter;

(d) The techniques employed in conducting and evaluating noise measurement surveys;

(e) The methods employed in controlling noise exposure; and,

(f) The substantive noise requirements of the Federal Coal Mine Health and Safety Act of 1969 (Public Law 91-173).

Persons satisfactorily completing a program in noise measurement training conducted or approved by the Bureau of Mines will be certified by the Bureau as qualified to conduct tests of noise levels at underground coal mines.

Approval of programs. Applications for approval of noise measurement training programs should be submitted to:

Director, Bureau of Mines, Department of the Interior, Washington, DC 20240.

Such applications shall contain the following information:

(a) The name, address, and title of the applicant;

(b) The name and address of the instructors,

(c) The address of the facility where the training will be conducted;

(d) The physical capacity of the training facility and the nature of educational aids provided;

(e) The approximate number of persons to be trained;

(f) The format of the training program and the time assigned to each topic;

(g) A general description of the source material to be employed by the instructor and the material to be supplied to each trainee; and

(h) A general description of the practical training to be provided in the use of the sound pressure level meter.

The Bureau of Mines shall certify as approved any noise measurement training program which meets the minimum requirements set forth in this notice. However, the Bureau reserves the right to withdraw such certification where the applicant fails to provide the training set forth in his application for approval.

Instructors. Applications for certification as an instructor in noise measurement training programs should be submitted to:

Director, Bureau of Mines, Department of the Interior, Washington, D.C. 20240.

Such applications shall include the following information:

(a) The name and address of the applicant; and

(b) Information showing that the applicant meets at least one of the following criteria:

(1) He is an industrial hygienist currently certified by the American Industrial Hygiene Association Board;

(2) He is an industrial hygienist with a minimum of 10 years practical experience in the mining industry;

(3) He has acquired, by education, training, and experience in the mining industry, a thorough working knowledge of industrial noise criteria, experience in the operation of the instruments employed in conducting sound level studies, and has satisfactorily completed educational training courses in the measurement and control of noise, or has published articles relating to the measurement and control of noise which reflect his knowledge of the subject;

(4) He has conducted or is currently conducting a course in acoustics or industrial noise control and sound level management in a recognized institution of higher learning; or,

(5) He has provided or is currently providing training in acoustics or industrial noise control and sound level measurement in a vocational training program.

Qualified persons. Applications for certification as a person qualified to conduct tests of noise levels at underground coal mines should be submitted to:

Director, Bureau of Mines, Department of the Interior, Washington, D.C. 20240.

Such applications shall include the following information:

(a) The name and address of the applicant; and,

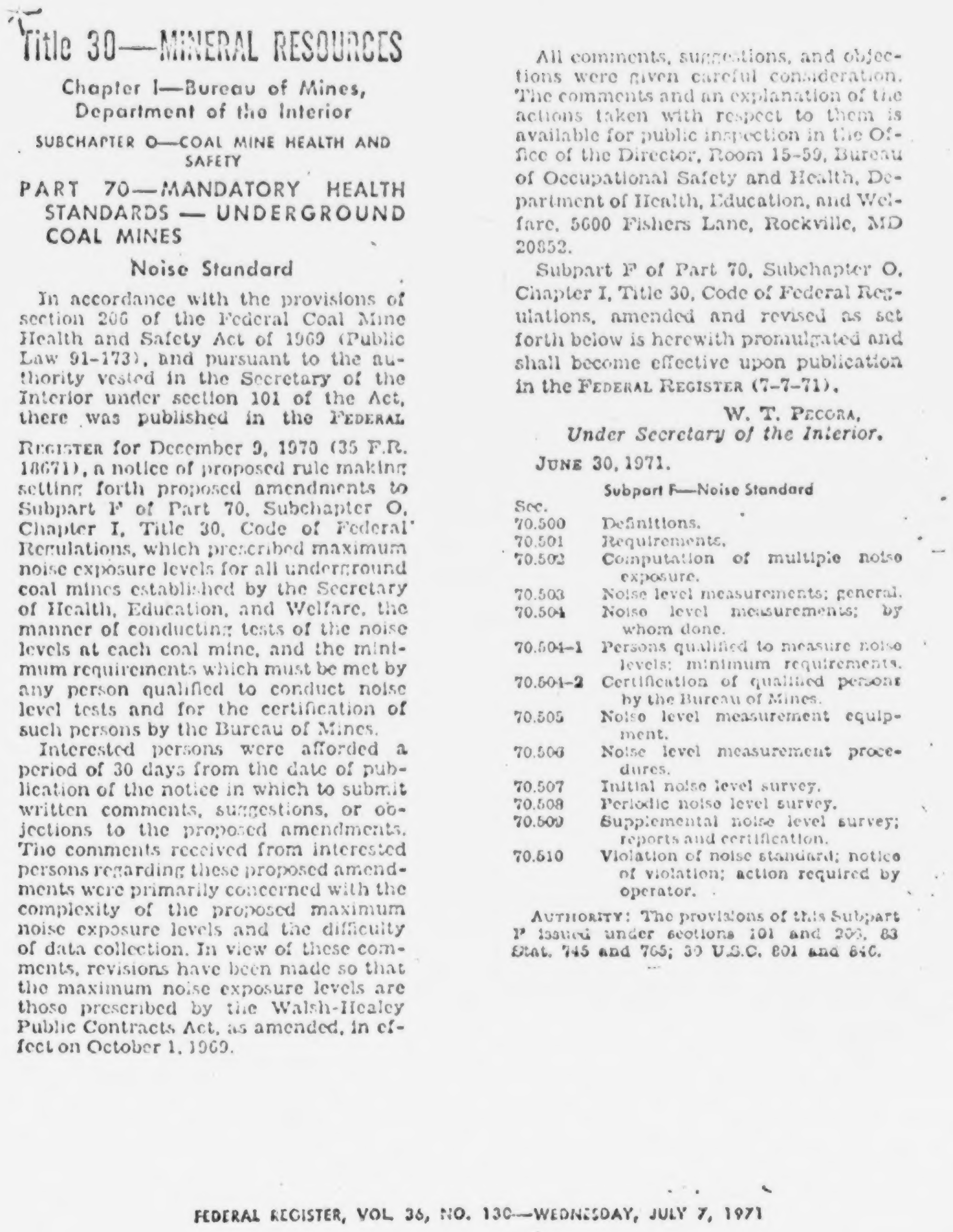
(b) Information showing the applicant is certified as an instructor in noise measurement training programs or has satisfactorily completed a program in noise measurement training conducted or approved by the Bureau of Mines.

FRED J. RUSSELL,
Acting Secretary of the Interior.

DECEMBER 1, 1970.

[F.R. Doc. 70-16533; Filed, Dec. 8, 1970; 8:51 a.m.]

SOURCE: Reference 2



Title 30—MINERAL RESOURCES

Chapter I—Bureau of Mines, Department of the Interior

SUBCHAPTER O—COAL MINE HEALTH AND SAFETY

PART 70—MANDATORY HEALTH STANDARDS — UNDERGROUND COAL MINES

Noise Standard

In accordance with the provisions of section 206 of the Federal Coal Mine Health and Safety Act of 1969 (Public Law 91-173), and pursuant to the authority vested in the Secretary of the Interior under section 101 of the Act, there was published in the FEDERAL REGISTER for December 9, 1970 (35 F.R. 18671), a notice of proposed rule making setting forth proposed amendments to Subpart F of Part 70, Subchapter O, Chapter I, Title 30, Code of Federal Regulations, which prescribed maximum noise exposure levels for all underground coal mines established by the Secretary of Health, Education, and Welfare, the manner of conducting tests of the noise levels at each coal mine, and the minimum requirements which must be met by any person qualified to conduct noise level tests and for the certification of such persons by the Bureau of Mines.

Interested persons were afforded a period of 30 days from the date of publication of the notice in which to submit written comments, suggestions, or objections to the proposed amendments. The comments received from interested persons regarding these proposed amendments were primarily concerned with the complexity of the proposed maximum noise exposure levels and the difficulty of data collection. In view of these comments, revisions have been made so that the maximum noise exposure levels are those prescribed by the Walsh-Healey Public Contracts Act, as amended, in effect on October 1, 1969.

All comments, suggestions, and objections were given careful consideration. The comments and an explanation of the actions taken with respect to them is available for public inspection in the Office of the Director, Room 15-59, Bureau of Occupational Safety and Health, Department of Health, Education, and Welfare, 5600 Fishers Lane, Rockville, MD 20852.

Subpart F of Part 70, Subchapter O, Chapter I, Title 30, Code of Federal Regulations, amended and revised as set forth below is herewith promulgated and shall become effective upon publication in the FEDERAL REGISTER (7-7-71).

W. T. PECORA,
Under Secretary of the Interior.

JUNE 30, 1971.

Subpart F—Noise Standard

Sec.	
70.500	Definitions.
70.501	Requirements.
70.502	Computation of multiple noise exposure.
70.503	Noise level measurements; general.
70.504	Noise level measurements; by whom done.
70.504-1	Persons qualified to measure noise levels; minimum requirements.
70.504-2	Certification of qualified persons by the Bureau of Mines.
70.505	Noise level measurement equipment.
70.506	Noise level measurement procedures.
70.507	Initial noise level survey.
70.508	Periodic noise level survey.
70.509	Supplemental noise level survey; reports and certification.
70.510	Violation of noise standard; notice of violation; action required by operator.

AUTHORITY: The provisions of this Subpart F issued under sections 101 and 206, 83 Stat. 745 and 765; 30 U.S.C. 801 and 846.

FEDERAL REGISTER, VOL. 36, NO. 130—WEDNESDAY, JULY 7, 1971

SOURCE: Reference 3

Subpart F—Noise Standard

§ 70.500 Definitions.

As used in this Subpart F, the term:

(a) "dBA" means noise level in decibels, as measured with the A-weighted network of a standard sound level meter using slow response;

(b) "Noise exposure" means a period of time during which the noise level is 90 or more dBA;

(c) "Multiple noise exposure" means the daily noise exposure is composed of two or more different noise levels;

(d) "Noise level" is the average dBA during a noise exposure; and,

(e) "Qualified person" means, as the context requires, an individual deemed qualified by the Secretary and designated by the operator to make tests and examinations required by this Act.

§ 70.501 Requirements.

Every operator of an underground coal mine shall maintain the noise levels during each shift to which each miner in the active workings of the mine is exposed at or below the permissible noise levels set forth in Table I of this subpart.

EXAMPLE: If a noise is recorded to be 110 dBA then exposure shall not exceed 30 minutes during an 8-hour shift.

§ 70.502 Computation of multiple noise exposure.

The standard will be considered to have been violated in the case of multiple noise exposure where such exposure totals exceed one as computed by adding the total time of exposure at each specified level (C_1, C_2, C_3 etc.) divided by the total time of exposure permitted at that level (T_1, T_2, T_3). Thus,

$$\frac{C_1}{T_1}+\frac{C_2}{T_2}+\frac{C_3}{T_3} \text{ must not exceed 1.}$$

EXAMPLE I: Exposure of 2 hours at 92 dBA and 1 hour at 100 dBA during an 8-hour shift.

$$\frac{\text{Total minutes of noise exposure at dBA level}}{\text{Total minutes of permissible noise exposure at dBA level}}$$

$$\frac{120 \text{ min.}}{360 \text{ min.}}+\frac{60 \text{ min.}}{120 \text{ min.}}=\frac{1}{3}+\frac{1}{2}=\frac{2}{6}+\frac{3}{6}=\frac{5}{6}$$

The sum of the fractions does not exceed one; hence the exposure for the shift would not violate the standard.

EXAMPLE II: Exposure of 3 hours at 95 dBA and 1 hour at 100 dBA during an 8 hour shift.

$$\frac{3}{4}+\frac{1}{2}=\frac{3}{4}+\frac{2}{4}=\frac{5}{4}$$

The sum of the fractions exceeds one; hence the exposure for the shift would violate the standard.

§ 70.503 Noise level measurements; general.

Every coal mine operator shall take accurate readings of the noise levels to which each miner in the active workings of the mine is exposed during the performance of the duties to which he is normally assigned.

§ 70.504 Noise level measurements; by whom done.

The noise level measurements required by this Subpart F shall be taken by, or as directed by, a person who has met the minimum requirements set forth in § 70.504-1, and has been certified by the Director, Bureau of Mines as qualified to take noise level measurements as prescribed in this Subpart F.

§ 70.504-1 Persons qualified to measure noise levels; minimum requirements.

The following persons shall be considered qualified to take noise level measurements as prescribed in this Subpart F;

(a) Any person who has been certified by the Bureau of Mines as an instructor in noise measurement training programs;

(b) Any person who has satisfactorily completed a noise training course conducted by the Bureau of Mines and has been certified by the Bureau as a qualified person; and,

(c) Any person who has satisfactorily completed a noise training course approved by the Bureau of Mines and has been certified by the Bureau as a qualified person.

§ 70.504-2 Certification of qualified persons by the Bureau of Mines.

Upon a satisfactory showing that a person has met the minimum requirements for taking noise level measurements set forth in § 70.504-1, the Bureau of Mines shall certify that such person has the ability and capacity to conduct tests of the noise levels in a coal mine and to report and certify the results of such tests to the Secretary and the Secretary of Health, Education, and Welfare.

§ 70.505 Noise level measurement equipment.

(a) Noise level measurements shall be taken only with instruments which are approved by the Bureau of Mines as permissible electric face equipment under the provisions of Part 18 of this chapter (Bureau of Mines, Schedule 2G), and which meet the operational specifications of the American National Standards Institute for Sound Level Meters S1.4-1971 (Type S2A).

(b) Noise level measurement equipment shall be set to operate with the A-weighted network and slow response and shall be acoustically calibrated in accordance with the manufacturer's instructions before, during and after each shift on which such equipment is used.

§ 70.506 Noise level measurement procedures.

(a) Noise level measurements shall be made at locations where the noise is typical of that entering the ears of the miner whose exposure is under consideration.

(b) Five measurements shall be made for each type of noise exposure producing operation to which the miner under consideration is exposed.

(c) Each measurement shall be made by observing the A-scale readings for 30 seconds and recording the noise level.

(d) The average of the five noise level measurements shall be considered as the noise level measurement which is representative of the operation.

(e) Where different and distinct noise levels occur at various phases of an operation, noise level measurements shall be made in accordance with this section for each distinct phase.

(f) The noise levels and the estimated length of time the miner is exposed to each level during a normal work shift shall be reported for the operation. The range of the five noise level measurements used in paragraph (d) of this section shall also be reported.

§ 70.507 Initial noise level survey.

On or before June 30, 1971, each operator shall:

(a) Conduct, in accordance with this subpart, a survey of the noise levels to which each miner in the active workings of the mine is exposed during his normal work shift; and,

(b) Report and certify to the Bureau of Mines, and the Department of Health, Education, and Welfare, the results of such survey using the Coal Mine Noise Data Report, Figure 1. Reports shall be sent to:

Assistant Director, Coal Mine Health and Safety, Bureau of Mines, Department of the Interior, Washington, D.C. 20240.

§ 70.508 Periodic noise level survey.

(a) At intervals of at least every 6 months after June 30, 1971, but in no case shall the interval be less than 3 months, each operator shall conduct in accordance with this subpart, periodic surveys of the noise levels to which each miner in the active workings of the mine is exposed and shall report and certify the results of such surveys to the Bureau of Mines, and the Department of Health, Education, and Welfare, using the Coal Mine Noise Data Report Form. Reports shall be sent to:

Assistant Director, Coal Mine Health and Safety, Bureau of Mines, Department of the Interior, Washington, D.C. 20240.

(b) Where no A-scale reading recorded for any miner during an initial or periodic noise level survey exceeds 90 dBA the operator shall not be required to survey such miner during any subsequent periodic noise level survey required by this section: *Provided, however,* That the name and job position of each such miner shall be reported in every periodic survey and the operator shall certify that such miner's job duties and noise exposure levels have not changed substantially during the preceding 6-month period.

§ 70.509 Supplemental noise level survey; reports and certification.

(a) Where the certified results of an initial noise level survey conducted in accordance with § 70.507, or a periodic noise level survey conducted in accordance with § 70.508, show that any miner in the active workings of the mine is exposed to a noise level in excess of the permissible noise level prescribed in Table I, the operator shall conduct a supplemental noise level survey with respect

SOURCE: Reference 3

to each miner whose noise exposure exceeds this standard. This survey shall be conducted within 15 days following notification to the operator by the Bureau of Mines to conduct such survey.

(b) Supplemental noise level surveys shall be conducted by taking noise level measurements in accordance with § 70.506, however, noise level measurements shall be taken during the entire period of each individual operation to which the miner under consideration is actually exposed during his normal work shift.

(c) Each operator shall report and certify the results of each supplemental noise level survey conducted in accordance with this section to the Bureau of Mines and the Department of Health, Education, and Welfare using the Coal Mine Noise Data Report Form to record noise level readings taken with respect to all operations during which such measurements were taken.

(d) Supplemental noise level surveys shall, upon completion, be mailed to:

Assistant Director, Coal Mine Health and Safety, Bureau of Mines, Department of the Interior, Washington, D.C. 20240.

§ 70.510 Violation of noise standard; notice of violation; action required by operator.

(a) Where the results of a supplemental noise level survey conducted in accordance with § 70.509 show that any miner in the active workings of the mine is exposed to noise levels which exceed the permissible noise levels prescribed in Table I, the Secretary shall issue a notice to the operator that he is in violation of this subpart.

(b) Upon receipt of a Notice of Violation issued pursuant to paragraph (a) of this section, the operator shall:

(1) Institute promptly administrative and/or engineering controls necessary to assure compliance with the standard. Such controls may include protective devices other than those devices or systems which the Secretary or his authorized representative finds to be hazardous in such mine.

(2) Within 60 days following the issuance of any Notice of Violation of this subpart, submit for approval to a joint Bureau of Mines-Health, Education, and Welfare committee, a plan for the administration of a continuing, effective hearing conservation program to assure compliance with this subpart, including provision for:

(i) Reducing environmental noise levels;

(ii) Personal ear protective devices to be made available to the miners;

(iii) Preemployment and periodic audiograms.

(3) Plans required under subparagraph (2) of this paragraph shall be submitted to:

Assistant Director, Coal Mine Health and Safety, Bureau of Mines, Department of the Interior, Washington, D.C. 20240.

TABLE I—PERMISSIBLE NOISE EXPOSURES

Duration per day (hours)	*Noise level (dBA)*
8	90
6	92
4	95
3	97
2	100
1½	103
1	105
¾	107
½	110
¼ or less	115

Figure 1

(Submit one form for each miner)

COAL MINE NOISE DATA REPORT

Date:------------ Mine ID No.:------
Section ID No.:------ Miner's SSA No.:------
Occupation: ----------------------------------
Actual production—tons this shift:---------
Type of mining:
  Development ---------------------------
  Retreat ---------------------------------
Method of mining:
  Continuous ------------------------------
  Conventional ---------------------------
  Longwall --------------------------------
  Other ------------------------------------
Equipment in operation:
  Electric ----------------------------------
  Pneumatic -------------------------------
  Other -------------------------------------
  Voltage------ Pressure-p.s.i.------
  a.c. or d.c.------------
Total horsepower------------
Description of equipment (make, model No., order No., etc.):------------------------

----

Seam conditions: Name of seam:-----------

Coal height—inches:------
Average width of place:------------
Type of roof (sandstone, slate, etc.):--------

Hearing protective device used?
  Yes------ No------
Type and model number of sound level meter: ---------------------------------
Check if section will be closed before next sampling: Yes------ No------
☐ Initial survey ☐ Periodic survey ☐ supplementary survey
Signature of qualified person:-------------

Figure 1
Page 2

Coal Mine Noise Data Report

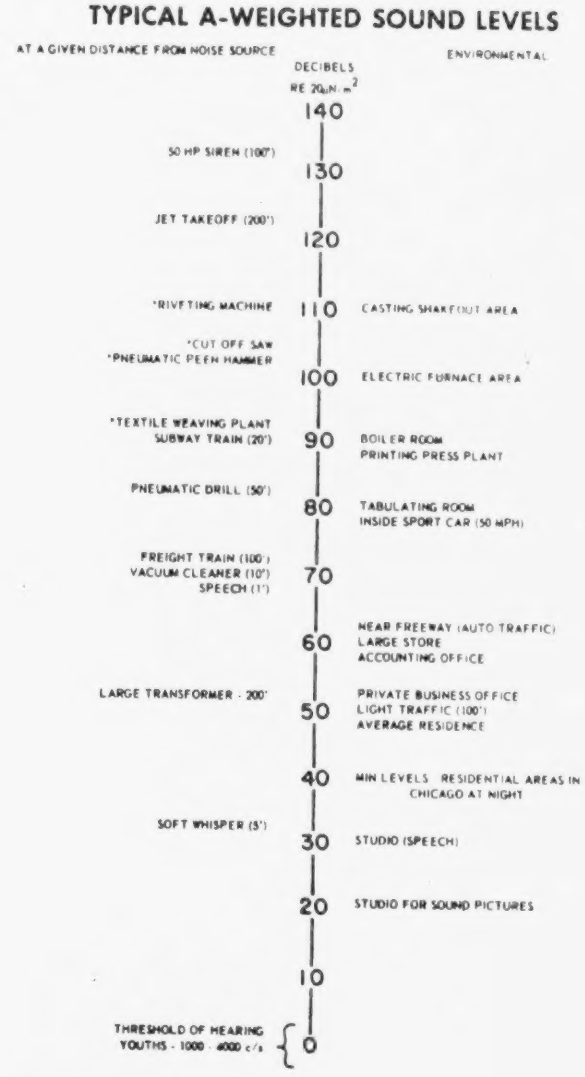
Date: ------------ Mine ID No.: ------
List noise level measurements for each level of exposure.

Operation (loading, tramming, etc.	Noise level dBA average	Range (high and low readings)	Cumulative exposure-minutes
Mantrip----	------------	------------	------------

Signature of qualified person:-------------

[FR Doc.71-9501 Filed 7-6-71;8:45 am]

SOURCE: Reference 3



*OPERATOR'S POSITION

Figure 2-1. Typical A-weighted sound levels measured with a sound-level meter. These values are taken from the literature. Sound-level measurements give only part of the information usually necessary to handle noise problems, and are often supplemented by analysis of the noise spectra.

SOURCE: Reference 4

UNIT #13

TITLE: Proposed Federal Surface Mining Legislation

PURPOSE: To acquaint the industry (management and labor) with its image and steps to be taken to improve the image, and with the various bills now being considered by the Congress which are related to surface mining. Should a bill be passed by the Congress, it should be discussed in detail.

OUTLINE:

I. All Current News Items on Surface Mining
    A. Newspapers
    B. Magazines--non-professional
    C. Television and radio editorials
    D. The surface mining industry's image

II. How to Improve the Image
    A. Be proud of operation
    B. Show operation to public
    C. Show operation to press
    D. Be a good neighbor
    E. Explain differences between past and present operations

III. Bills on Surface Mining in Congress
    A. Highlights of each bill
    B. What each bill means to the industry
    C. What each bill means to the public

REFERENCES:

1. Current newspaper and magazine (non-professional) articles.

2. Copies of television and radio editorials.

3. Copies of bills introduced in the Congress.

*4. Anonymous, "Change That Image," Coal Mining & Processing, p. 30 (June 1972).

5. Hylton, Tracy W. "Panel--Strip Mine Reclamation--Challenges, Planning and Concepts--East," Proceedings of the American Mining Congress 1972 Coal Show, Cleveland, Ohio (May 8-11, 1972).

*Enclosed.

COMMENT ◂◂◂

Change that image!

Let's face it: the coal industry probably has a worse image in the eyes of the general public than has any other major U.S. industry! This is not only unfortunate, it's unwarranted, unfair, and unrealistic. For no other industry has contributed more to the growth of our nation. Nor is any industry more vital today to our country's existence, not to mention its progress.

The contribution and importance of the coal industry to our populace goes unrecognized and unheralded. The average man in the street simply is not aware of how much his daily way of life depends upon coal and its many byproducts. He doesn't know or realize the extent of this contribution to man and nation, so therefore he can't appreciate it.

Neither does the average individual know of the great strides made by the coal industry in past years to mechanize its mining operations, to produce cleaner coal with better processing procedures and equipment, to improve the working conditions of the miners, and to do a better job of reclamation.

The general public should be made aware of the key role that coal and its byproducts are playing in the constant improvement of our economy, and should be updated on our industry's progress. Coal as an industry must have the understanding and support of the public, particularly now because of the heavy attack from extremists in the popular environmental movement. If these critics have their way, there will be no mining at all, coal or otherwise. In their overzealous crusade to protect the land and control pollution – and we don't deny that some control is necessary – they ignore the fact that our way of life is dependent upon the products of mining.

The National Coal Association, the American Mining Congress, and others have tried diligently to inform and educate the public about the benefits of coal mining to us all. They have published and distributed informative booklets and have sent educational news stories to the press. The effect of their admirable efforts, however, has been limited. It isn't feasible to send a booklet to every man, woman, and child in the nation. And the newspapers are prone to give front-page coverage to the few mine disasters and Buffalo Creek tragedies, while burying in the back pages or completely ignoring the many constructive and informative stories about the industry.

So what can be done? An answer, it seems to us, is to follow a similar approach as that used by other energy-supply industries – electric utility, gas and oil – to really get the job done. Why not try the regular use of institutional ads, particularly in the mass media where they'll reach the most people? Associations and groups in the other energy-source industries regularly put their story before the public in that fashion – telling of their important place in the economy and how they contribute to personal comfort and well-being. They do this through a continuing program of advertising in large-circulation consumer magazines and on network TV.

We suggest that the various coal and mining groups seriously consider setting aside a portion of their budgets for a well-designed national advertising campaign to change the poor image that the public now has of our industry. If coal can't get the image it deserves through news releases and educational literature, then it's time to spend some money to get the proper story distributed through mass media advertising.

UNIT #14

TITLE: State Government Organization and State Strip Mining Law

PURPOSE: To acquaint the industry (management and labor) with the state government organization and operation, and the state strip mining law.

OUTLINE:

I. The Governor

  A. Name and time in office
  B. Attitude on strip mining

II. The Legislature

  A. Number of senate and house of representative districts
  B. Names of senators and representatives in coal producing areas
  C. Attitudes of these senators and representatives on strip mining
  D. Methods of discussing strip mining problems with members of the legislature

III. Department of Natural Resources, and Geological Survey

  A. Organization
  B. Purpose
  C. Functions

IV. State Bureau of Mines

  A. Organization
  B. Purpose
  C. Function
  D. Mine inspection districts
  E. Names of mine inspectors
  F. Powers of the inspectors

V. Land Reclamation Committee

  A. Makeup and names of committee members
  B. Duties

    1. Approve mining and reclamation plans
    2. Review reports
    3. Determine bonds
    4. Develop guidelines
    5. Others

UNIT #14 continued

- C. Water Resources Administration, and Fish and Wildlife Administration

  1. Organization
  2. Purpose
  3. Functions

- D. Department of Forests and Parks (relationship to strip mining)
- E. County Soil Conservation Districts (relationship to strip mining)
- F. Site Evaluation Committee

  1. Organization
  2. Duties and responsibilities

- G. Water Inspectors

  1. Names and districts
  2. Duties and responsibilities

VI. State Strip Mining Law

- A. Purpose
- B. Definitions
- C. License requirements
- D. Permit requirements
- E. Bond requirements
- F. Required reports
- G. Backfilling requirements
- H. Planting requirements
- I. Forfeitures
- J. Penalties

REFERENCES:

1. Government manuals.

2. State strip mining law.

UNITS #15-16

TITLE: **State Strip Mining Regulations, Forms and Reports**

PURPOSE: To acquaint the industry (management and labor) with the regulations as promulgated by the Land Reclamation Committee, with all forms required for strip mining licenses and permits, and with all reports required by the state Bureau of Mines.

OUTLINE:

I. Explanation of All Rules and Regulations Promulgated By the Regulatory Body

  A. Definitions
  B. Map requirements
  C. Monuments
  D. Surface water diversion
  E. Silt dams
  F. Water discharges
  G. Deep mine drainage
  H. Acid refuse disposal
  I. Timbering
  J. Topsoil handling
  K. Highways, buildings and property line
  L. Backfilling requirements

    1. Approximate original contour
    2. Terracing

  M. Haulage roads
  N. Inactive permits
  O. Sanitary landfills
  P. Planting
  Q. Special fees
  R. Auger mining
  S. Safety

II. Explanation of All Forms Required By the Regulatory Body

  A. Licenses
  B. License renewal
  C. Permits

    1. Mining
    2. Mine drainage
    3. Reclamation
    4. Planting
    5. Amendments

  D. Equipment list

UNITS #15-16 continued

E. Map preparation
F. Consent of land owner
G. Bonds

III. Explanation of All Reports Required By the Regulatory Body

A. Monthly progress
B. Special accidents
C. Annual

1. Mining
2. Reclamation

a. Backfilling
b. Planting

D. Completion

IV. Special Notices Required By the Regulatory Body

A. Violations
B. Failure to Comply
C. Request for Hearing
D. Court Action

REFERENCES:

1. Copies of all state rules and regulations.

2. Copies of all state forms and reports.

UNIT #17

TITLE: Mine Water Drainage and Its Control in Coal Surface Mining

PURPOSE: To provide an understanding of the nature of coal mine drainage as it relates to formation, prevention, control and treatment in surface mining. This background is designed to assist the operator in complying with federal and state regulations.

OUTLINE:

I. The Formation of Coal Mine Drainage

    A. Reactants and reactions
    B. Factors controlling rates of pyrite oxidation

        1. Mode of oxygen transport
        2. Effect of bacteria

    C. Pyrite-ferric ion reaction

II. The Nature of Coal Mine Drainage

    A. Components
    B. Level of concentration
    C. Analysis
    D. Significance of the various components

        1. Prevention
        2. Control
        3. Treatment

    E. Control of siltation and erosion
    F. Relation to local geology and hydrology

III. Reducing Volume and Improving Quality of Coal Mine Drainage

    A. Measures to be applied prior to and during surface mining operations
    B. Diversion ditches above and around mine areas
    C. Removal of water from highwall springs and aquifers
    D. Water collection in sumps and its removal
    E. Dewatering flooded deep mines

IV. Treatment of Coal Mine Drainage

    A. Reagents and their use

        1. Hydrated lime
        2. Sodium bicarbonate

UNIT #17 continued

3. Sodium hydroxide
4. Calculation of reagent quantities
5. Costs of reagents

B. Oxidation of ferrous iron

1. Reaction and condition
2. Baffles
3. Surface aerators
4. Use of bacteria

C. Settling of sludge and slimes

1. Settling rates
2. Use of flocculants
3. Thickeners
4. Settling basins
5. Disposal of sludge
6. Problems developed by clay slimes and other forms of siltation

V. Drainage Control After Surface Mining

A. Planning for drainage control as part of reclamation operation
B. Diversion and drainage ditches
C. Compaction and covering of refuse and pyrite-containing strata to minimize seepage and solubilizing reactions
D. Vegetation to control seepage and erosion

VI. Refuse Piles and Retaining Dams

A. Location
B. Method of construction

1. Compaction
2. Layering procedures

C. Protection of refuse piles against

1. Erosion
2. Impeding drainage
3. Shifting of contents

D. Construction and inspection of retaining dams

UNIT #17 continued

REFERENCES:

1. Dutcher, R. E., et al. "Mine Drainage, Part I: Abatement, Disposal, Treatment. Part II: The Hydrogeologic Setting," Mineral Industries, Volume 36, Number 3-4, The Pennsylvania State University, University Park, Pennsylvania (December 1966--January 1967).

2. Hill, R. D. Mine Drainage Treatment--State of the Art, U. S. Department of the Interior, Federal Water Pollution Control Administration, Cincinnati, Ohio (1968).

3. Anonymous. "Mine Drainage and Acid Water Treatment," Mining Guidebook, Coal Age, McGraw-Hill, Inc., New York, pp. 7, 77 & 159, (July 1972).

4. Anonymous. Drainage Handbook for Surface Mining, West Virginia Department of Natural Resources, Division of Reclamation, Charleston, West Virginia (January 1972).

5. Anonymous. Mine Drainage Manual, Publication Number 12, Second Edition, Pennsylvania Department of Health, Harrisburg, Pennsylvania (June 1966).

6. **Federal Register**, Title 36, Number 100, "Mandatory Safety Standards," "Surface Coal Mines and Surface Work Areas of Underground Mines," "Refuse Piles and Retaining Dams;" Sections 77.214, 77.215 and 77.216; pp. 9364-85.

7. Bituminous Coal Research. Mine Drainage Abstracts, Annual from 1964.

8. Proceedings of the Coal Mine Drainage Research Symposia: 1965, 1968, 1970 & 1972.

9. **Mine Drainage Pollution Control Reports**, Office of Research and Monitoring, Environmental Protection Agency, Washington, D. C.

10. Maneval, D. R. "Coal Mining vs Environment," Appalachia, Volume 5, Number 4, pp. 10-40 (February-March 1972).

11. Preate, E. D., Jr. "A New Law for an Old Problem," Appalachia, Volume 5, Number 4, pp. 41-53 (February-March 1972).

UNIT #18

TITLE: Federal and State Laws--Standards for Water Control in Surface Mining

PURPOSE: To describe governmental laws and standards covering coal mine drainage control in surface mining.

OUTLINE:

I. Federal Regulations

  A. Federal Water Pollution Control Act and Amendments of 1972

    1. Function as a permit system under the Environmental Protection Agency in coordination with appropriate state agencies
    2. Guidelines being established which may supersede state requirements (will include water treatment and coal preparation plants)
    3. Principle

      a. Discharges must meet "best practical technology" by 1977, and "best available technology" by 1983.

      b. Will supersede enforcement of Refuse Act of 1899.

  B. Anticipated discharge requirements

    1. pH: 6.0 to 9.0
    2. Suspended solids: 30 mg/1
    3. Iron: 4 mg/1
    4. Acidity: alkalinity greater than acidity
    5. Grease: 5 to 10 mg/1
    6. No toxic materials: to be defined

  C. Federal Coal Mine Health and Safety Act of 1969

    1. Refuse piles
    2. Retaining dams

II. State Regulations and Standards (Ref. 3, 4, & 5)

  A. Purpose

    1. Provide for protection and conservation of natural resources of the state
    2. Decrease soil erosion

UNIT #18 continued

3. Aid in prevention of the pollution of rivers and streams (Section 657)
4. To not permit a decrease in water quality from mining
5. Definition of terms

   a. Industrial waste
   b. Oil
   c. Other wastes
   d. Toxic materials
   e. Treatment works

B. Agencies (Department of Natural Resources)

   1. Geological Survey--Bureau of Mines

      a. Develop regulations and enforce rules to prevent, minimize and repair damages to land
      b. To encourage mining industry
      c. Inspection

   2. Water Resources Administration (inspection)
   3. Forest Services (inspection)
   4. Fisheries Administration
   5. Wildlife Administration
   6. Water Resources Commission (advisory)
   7. Land Reclamation Committee

      a. Establish guidelines for lands disturbed by surface mining
      b. Must approve mining application

   8. Soil Conservation Districts (advisory)

C. Licenses, permits and plans

   1. Application for license to strip mine coal (Section 661) and annual renewal
   2. Application for permit to strip mine coal (Section 662), which requires information on drainage area, streams and detailed plan for each operation
   3. Mining and reclamation plan (Section 662-b-1)
   4. Request to impound water (Section 665-e)
   5. Permit to discharge water (Regulations 4.7)
   6. Notice of intent to prospect (Section 1.14)
   7. Reports

      a. Annual
      b. Mining and reclamation progress
      c. Completion of final report (Section 664)

UNIT #18 continued

   8. Permit for use of toxic material (Section 4.7)

D. Bonding and fees

   1. Special reclamation fee (Section 662-c)
   2. Amounts (Section 663)
   3. Limitation for forfeiture (Section 663-c)

E. Inspection (Section 664-c) by

   1. Director or his agent of the Bureau of Mines
   2. Land Reclamation Committee

F. Regulations and standards

   1. Control of potential to pollute and responsibility for pollution (Ref. 6, Section 29-D)
   2. Responsibility for prevention avoidable pollution in excess of standards established by Water Resources Administration (Ref. 3, Section 662-d)
   3. Avoid creating danger from water impoundment (Section 665-d)
   4. Diversion of surface water (Section 1.03)

      a. Minimize entry into pits
      b. Prevent discharge acid drainage
      c. Control sediment run-off

   5. Construction of structural measures, as silt dams (Section 1.03)
   6. Conveying water through and from strip pit to prevent acid water formation and erosion, including suitable means to carry water through spoil pile (Section 1.04)
   7. Deep mine openings must be by-passed if they contain significant amounts of water, or sealed if they are opened (Section 1.05)
   8. Disposal of acid-forming refuse to prevent pollution by covering and grading (Section 1.06)
   9. Backfilling must prevent formation of depressions to hold water--lateral drainage ditch requirements (Sections 1.10b-1d,e and c-2d,e,f)
   10. Auger mining shall not permit release of impounded water except under controlled conditions (Section 3.06)
   11. Reclamation procedures require seeding to provide a quick cover to prevent erosion and conveying silt into streams

UNIT #18 continued

12. Specific water quality standards (may be lower in some cases)
    a. Solids size: <20 mesh
    b. Suspended solids: <400 ppm
    c. Dissolved solids: <1500 ppm
    d. Total solids: <1900 ppm
    e. Turbidity: <300 JTU
    f. Toxicity: limit of tolerance to humans, aquatic life, etc.
    g. pH: 5.5 to 8.5
    h. Oils and grease: 30 mg/l
    i. Iron: 7 mg/l

G. Penalties

1. Failure to obtain license (Section 661-b)
2. Restrictions of non-compliance

REFERENCES:

1. Public Law 92-500, Federal Water Pollution Control Act and Amendments of 1972.

2. Public Law 91-173, Federal Coal Mine Health and Safety Act of 1969.

3. Strip Mining Laws of the State of Maryland (1971) and Amendments of Article 66c of the Annotated Code of Maryland (1970 Replacement Volume).

4. Requirements for a Discharge Permit, State of Maryland, Water Resources Regulation 4.7 (October 1, 1971).

5. Regulation Number 1, Supplementing the Maryland Strip Mine and Auger Mining Laws (June 24, 1970).

6. Water Resources Law of Maryland, Article 96A, Annotated Code of Maryland (1957 and 1971), Cumulative Supplement.

7. Hawes, Loring E., Assistant Attorney General, State of Maryland. Opinion on Agency Responsibility for Abatement of Pollution by Acid Mine Drainage (April 1, 1966).

8. Power, Garrett. Legal Problems of Coal Mine Reclamation, Environmental Protection Agency, Number 14010 FZU (March 1972).

UNIT #18 continued

9. Water Resources Regulation 4.8, State of Maryland, General Water Quality Criteria and Specific Water Quality Standards for All Maryland Waters (April 1969).

10. Water Resources Regulations, State of Maryland, Section 4: Regulations on Pollution Abatement.

UNIT #19

TITLE: Exploration and Premining

PURPOSE: To provide general information in regard to the activities and evaluations necessary before a new extraction operation is started.

OUTLINE:

I. Introduction: A brief description of the definition, objectives, attitudes and organization of exploration (Ref. 1)

  A. Definition: "All the activities and evaluations necessary before an intelligent decision can be made establishing size, initial flowsheet, and annual output of the new extractive operation."

  B. Objectives: "To find and acquire a maximum number of new economic mineral deposits with a minimum cost and in minimal time." While the strip mine is in operation, an additional search to increase reserves should be made, thereby expanding the operation.

  C. Attitudes: "An economic mineral deposit is made through imaginative and effective exploration."

  D. Organization: Coal exploration is usually divided into two main phases: reconnaissance and target investigation. (On the next page a flow diagram outlines these phases into a sequence of operations.) "A successful program is always marked by an increase in the favorability of the area explored in advancing from one stage to the next."

II. Reconnaissance

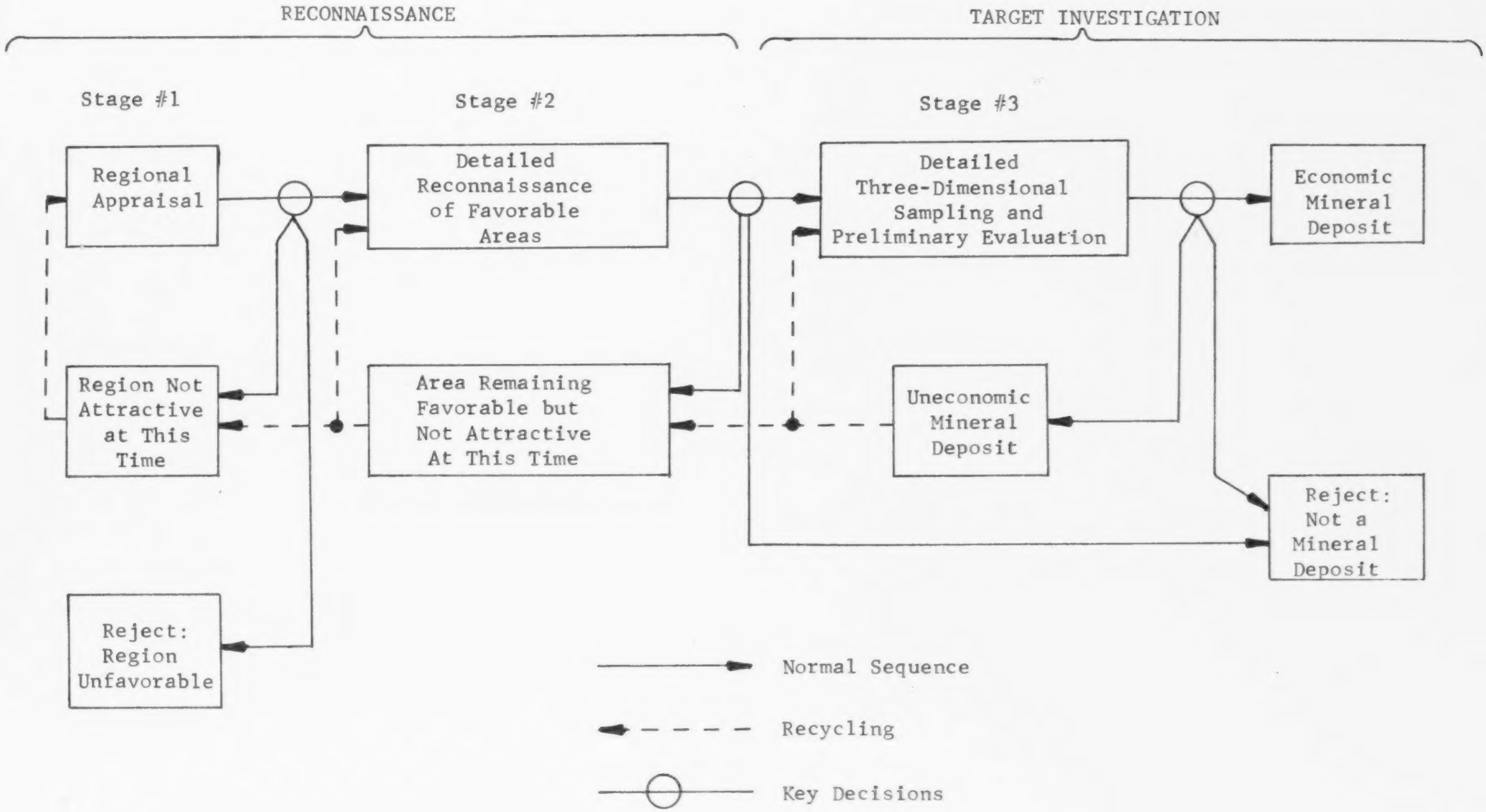
  A. The search for a coal seam in a geologically-mapped district does not involve this stage.

  B. It is likely in coal mining that after a quick regional appraisal, detailed reconnaissance is unnecessary.

  C. Regional appraisal: A geologic compilation to indicate if marketing area for coal is favorable, plus the initiation of map preparations (Ref. 1).

    1. Surface map preparations, topographic and aerial-photo bases--definitions, accuracy, scales, and conventions (Ref. 2).

THE THREE MAIN STAGES OF "FULL-SEQUENCE" COAL EXPLORATION


RECONNAISSANCE
TARGET INVESTIGATION
Stage #1
Stage #2
Stage #3
Regional Appraisal
Detailed Reconnaissance of Favorable Areas
Detailed Three-Dimensional Sampling and Preliminary Evaluation
Economic Mineral Deposit
Region Not Attractive at This Time
Area Remaining Favorable but Not Attractive At This Time
Uneconomic Mineral Deposit
Reject: Not a Mineral Deposit
Reject: Region Unfavorable
Normal Sequence
Recycling
Key Decisions

SOURCE: Reference 1

UNIT #19 continued

a. Definitions

1) Map: "A record of geologic facts in their correct space relations."

2) Topographic map: A map based on both horizontal and vertical control. Vertical control is established with contours or lines of equal elevation.

b. What to map: A reconnaissance map should contain only easily recognized features; details should be left for latter stages of exploration.

c. Conventions: Observed facts are entered as solid lines, interpretation as dotted or dashed lines.

2. Map bases

a. Topographic--example: Cerro de Pasco (Alidade and Plane table) Method. This is probably the most accurate topographic mapping; however, it requires actual field work.

b. Air photographs--advantages over topographic

1) Greater speed and economy in preparation
2) Abundance of landmarks
3) Capability of revealing geologic features not recognizable on the ground

c. Surface map requirements: It is best to prepare maps at a scale required by local government regulations. This obviously saves man effort in the long run.

D. Prospecting permits or notices of intent (Briefly summarize Subpart 3133, "Permits" of Circular Number 2154 USDI.)

1. Relates only to federal lands

2. Permits issued for a period of two years to qualified applicants to prospect unclaimed or undeveloped lands.

UNIT #19 continued

3. Permit is only authorized to remove such coal as may be necessary to evaluate the workability and commercial value of the discovered coal.

4. Applicant must furnish surety or personal bond.

E. Detail reconnaissance of favorable areas: Occurs after regional appraisal (if necessary) and is usually the initiation of fieldwork

1. First step is usually a field check of sections or areas containing coal seams.

2. Drilling and logging (Ref. 2)

   a. Reason: Reconnaissance drilling for stratigraphy and coal thickness. "Drill holes make it possible to investigate blocks of ground that by any other means would be accessible only at much greater expense."

   b. Types of drills: Diamond drill and churn drills are the types most widely used for sampling and exploration.

      1) Churn drill: Drilling is accomplished by lifting the bit a few feet, then dropping it. A churning motion of the bit abrades the ground, and the resulting sample is in the form of a sludge.

      2) Diamond drill: Sample is a continuous cone of rock which is cut with a ring-like bit armed with diamonds.

3. Analyses and physical tests on samples, cones, and cutting follow. Reason: Chemical and caloric check of outcrops or drill samples to see if coal is marketable.

F. The next primary stage of exploration--detailed three-dimensional physical sampling of target area. Principal areas of interest are

1. Additional drilling and logging plus analyses of samples (Ref. 3)

UNIT #19 continued

2. After the sample data is acquired, all material should be available for property evaluation (Ref. 2, 4 & 5). The evaluation should include reserves computations, taxes, leases, royalties, water problems and availability, suitability of ground for auxiliary surface facilities, to name a few.

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1. Bailey, P. A. "Exploration Methods and Requirements," Surface Mining, E. P. Pfleidler, Editor, AIME, New York, pp. 19-24 (1968).

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   Geologic Mapping, pp. 1-34
   Drilling and Logging, pp. 70-114
   Evaluation, pp. 428-502

3. Waterman, Glenn and Scott Hazen. "Development Drilling and Bulk Sampling," Surface Mining, pp. 69-102.

4. Sundeen, Stanley. "Preliminary Evaluations," Surface Mining, pp. 54-66.

5. Parks, R. D. Examination and Valuation of Mineral Property, Addison-Westley, Reading, Mass., 507 pp. (1957).

ADDITIONAL REFERENCES:

1. Bateman, A. M. Economic Mineral Deposits, Second Edition, John Wiley & Sons, New York, 916 pp. (1950).

2. Anonymous. "Planning the Pit," Engineering and Mining Journal, Open-pit Mining Guidebook, pp. G3-G6 (May 1954).

SUGGESTED HANDOUTS:

*"Leasing of Minerals Other Than Oil and Gas," Circular No. 2321, Bureau of Land Management, Department of the Interior, Washington, D. C. (March 7, 1972).

*Enclosed.

Circular No. 2321

REGULATIONS PERTAINING TO:

LEASING OF MINERALS OTHER THAN OIL AND GAS

As contained in Title 43 of the Code of Federal Regulations

U.S. Department of the Interior

Bureau of Land Management

Reprint of regulations current as of March 7, 1972

Group 3500—Leasing of Minerals Other Than Oil and Gas

PART 3500—LEASING OF MINERALS OTHER THAN OIL AND GAS; GENERAL

Subpart 3500—Introduction—General

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3500.0-3 Authorities.
3500.0-5 Definitions.
3500.1 Minerals subject to leasing.
3500.1-1 Public domain and acquired minerals.
3500.1-2 Reports required.
3500.1-3 Special acts.
3500.2 Multiple development.

Subpart 3501—Lands Subject to Leasing

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3501.1 Public Domain.
3501.1-1 Protection of preexisting rights.
3501.1-2 Unsurveyed lands, General.
3501.1-3 Description of lands in offer.
3501.1-4 Acreage limitations.
3501.1-5 Exceptions.
3501.1-6 Rejections.
3501.2 Acquired lands.
3501.2-1 Lands and deposits not subject to leasing.
3501.2-2 Sale or conveyance of lands.
3501.2-3 Outstanding prospecting permits and leases.
3501.2-4 Description of lands in application.
3501.2-5 Acreage limitations.
3501.2-6 Consent of administering agency.
3501.2-7 Lands subject to leasing.
3501.3 Withdrawn, reserved or segregated.
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3501.3-2 Consent of administrator.
3501.3-3 Transfer of surface control.
3501.4 Special leasing acts.
3501.4-1 Lands and deposits subject to prospecting and leases.
3501.4-2 Consent of administrator.

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3502.1-2 Bona fide purchasers.
3502.1-3 Where filed.
3502.2 Individuals.
3502.2-1 Statement of citizenship.
3502.2-2 Equitable rights affecting certain coal lands in Oklahoma.
3502.3 Associations including partnerships.
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3502.6-2 Evidence previously filed.
3502.7 Showing as to the sole party in interest.
3502.8 Heirs and devisees (estates).
3502.8-1. General.
3502.9 Municipality.
3502.9-1 Coal.

Subpart 3503—Fees, Rentals, and Royalties

3503.0-3 Authorities.
3503.1 Payments.
3503.1-1 Form of remittance.
3503.1-2 Where remitted.
3503.1-3 When remitted.
3503.2 Fees.
3503.2-1 General Statement.
3503.2-2 Exceptions.
3503.3 Rentals and royalties.
3503.3-1 General statement rentals.
3503.3-2 General statement royalties.

Subpart 3504—Bonds

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3504.2-1 Compliance bonds.
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3504.2-3 When filed.
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3504.3-2 Certificate required.
3504.3-3 Requirement.
3504.3-4 Terms.
3504.3-5 Forms.
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3504.4-1 Amount.
3504.4-2 Qualified sureties.
3504.5 Nationwide bond.
3504.5-1 Amount.
3504.6 Statewide bond.
3504.6-1 Amount.
3504.7 Collective bond.
3504.7-1 Amount.
3504.8 Default.
3504.8-1 Payment of surety.
3504.8-2 Penalty.
3504.8-3 Relief.
3504.8-4 Applicability of provisions to existing bonds.
3504.9 Exploration bond.
3504.9-1 See Title 43 CFR Part 23.

Subpart 3505—Cooperative Conservation Provisions

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Subpart 3500—Introduction—General

§ 3500.0-3 Authorities.

The statutory authority for leasing the minerals in this part is contained in the cited acts.

(a) *Public Domain.* The act of February 25, 1920 (41 Stat. 437; 30 U.S.C., 181 et seq.), as amended and supplemented, including the amendatory act of August 8, 1946 (60 Stat. 950; 30 U.S.C., sec. 181 et seq.) and the act of September 2, 1960 (74 Stat. 781; 30 U.S.C., sec. 181 et seq.), the act of February 7, 1927 (44 Stat. 1057; 30 U.S.C., 281-287) and the act of April 17, 1926 (44 Stat. 301; 30 U.S.C., 271-276) as amended, hereinafter called "the act", provide for the leasing of all leasing act minerals.

(1) *Coal.* Sections 2 to 8, inclusive, of the act of February 25, 1920 (41 Stat. 438 et seq., 30 U.S.C. 201, 202-208), as amended.

(2) *Potassium.* Sections 1 to 7 of the act of February 7, 1927, as amended (44 Stat. 1057, 30 U.S.C. secs. 281-287).

(3) *Sodium.* Sections 23 through 25 of the act of February 25, 1920 (41 Stat. 447; 30 U.S.C. sec. 189, 261-263).

(4) *Phosphate.* Sections 9 to 12, inclusive of the act of February 25, 1920 (41 Stat. 440, 441, 30 U.S.C. 211-214) as amended.

(5) *Sulphur.* Sections 1 to 7 of the Act of April 17, 1926 (44 Stat. 301), as amended July 16, 1932 (47 Stat. 701; 30 U.S.C. 271-276).

(6) *Asphalt.* The Act of February 25, 1920 (41 Stat. 437; 30 U.S.C., sec. 181), as amended by the Act of September 2, 1960 (74 Stat. 781; 30 U.S.C. sec. 181, 241).

(b) *Acquired lands*—(1) *Leasable.* (i) The Mineral Leasing Act for acquired lands; enacted on August 7, 1947 (61 Stat. 913; 30 U.S.C. 351-359).

(ii) The authority conferred upon the Secretary by the act, supersedes the authority conferred upon him by section 402 of Reorganization Plan No. 3 effective July 16, 1946 (3 CFR 1946 Supp., Chapter IV), except as to leases or permits outstanding on August 7, 1947.

(2) *Solid (hardrock) minerals.* (i) Section 402, Reorganization Plan No. 3 of 1946 (60 Stat. 1099) transferred the functions of the Secretary of Agriculture and the Department of Agriculture relative to the leasing or other disposal of minerals in certain acquired lands to the Secretary of the Interior.

(ii) Section 3 of the act of September 1, 1949 (63 Stat. 683) authorized the issuance of mineral leases or permits for the exploration, development and utilization of minerals, other than those covered by the Mineral Leasing Act for Acquired Lands, in certain lands added to the Shasta National Forest by the act of March 19, 1948 (62 Stat. 83).

(iii) Section 3 of the act of June 23, 1952 (66 Stat. 285), authorized the Secretary of the Interior to administer, in the manner prescribed by section 402 of Reorganization Plan No. 3 of 1946, mineral deposits other than those subject to the provisions of the Mineral Leasing Act for Acquired Lands, in that part of the Juan Jose Lobato Grant Numbered 164, which lies northerly of the Chama River (North Lobato tract) and in part of the Anton Chica Grant Numbered 29 (El Pueblo tract) as more particularly described in section 1 of the act of June 28, 1952.

(c) *Special acts.* (1) Gold and silver in confirmed private land grants. The act of Congress approved June 8, 1926 (44 Stat. 710; 30 U.S.C. 291–293).

(2) Asphalt in Oklahoma. The act of June 28, 1944 (58 Stat. 483–485).

(3) Silica sands and other nonmetallic minerals in certain lands in Nevada. The act of May 9, 1942 (56 Stat. 273) as amended by the act of October 25, 1949 (63 Stat. 886).

(i) Act of February 27, 1927 (44 Stat. 1057).

(ii) Leasable. Mineral Leasing Act of February 25, 1920 (41 Stat. 437) as amended.

(4) Leases of sand and gravel in certain lands patented to the State of Nevada. The act of June 8, 1926 (44 Stat. 708).

(5) Reserved minerals in lands patented to the State of California for park or other purposes. The act of March 3, 1933 (47 Stat. 1487), as amended by the act of June 5, 1936 (49 Stat. 1482) and the act of June 29, 1936 (49 Stat. 2026).

(6) Certain National Forest lands in Minnesota. (i) The act of June 30, 1950 (64 Stat. 311; 16 U.S.C. 508(b)).

(ii) Leasable. Mineral Leasing Act of February 25, 1920 (41 Stat. 437; 30 U.S.C. 181) as amended.

(7) Leases for minerals in lands withdrawn for reclamation purposes within the Lake Mead Recreation Area. The act of October 8, 1964 (78 Stat. 1039; 16 U.S.C. 460n).

(8) Prospecting and mineral leasing within National Forest Wilderness. National Forest Wilderness Act of September 3, 1964. (78 Stat. 890; 16 U.S.C. 1131–1136; 43 U.S.C. 1201.)

(9) Development of minerals in lands within Whiskeytown-Shasta-Trinity National Recreation Area. Section 6 of the act of November 8, 1965 (Public Law 89-336; 79 Stat. 1295). (i) Solid (Hardrock) minerals. (*a*) Section 10 of the act of August 4, 1939 as amended (53 Stat. 1196; 43 U.S.C. 387).

(*b*) Section 3 of the Act of September 1, 1949, (63 Stat. 683, 30 U.S.C. 192c).

(ii) Leasable. (*a*) Mineral Leasing Act of February 25, 1920 as amended (30 U.S.C. 181 et seq.).

(*b*) Acquired Lands Mineral Leasing Act of August 7, 1947, (30 U.S.C. 351–359).

§ 3500.0–5 Definitions.

(a) *Sole party in interest.* A sole party in interest in a lease or permit or an application for a lease or a permit is a party who is and will be vested with all legal and equitable rights under the lease or permit. No one is, or shall be deemed to be, a sole party in interest with respect to a lease or permit in which any other party has any of the interests described in this section. This requirement of disclosure in an application for lease or permit of an applicant's or other parties' interest in a lease or permit, if issued, is predicated on the departmental policy that all applicants and other parties having an interest in simultaneously filed applications for permits shall have an equal opportunity for success in the drawings to determine priorities. Additionally, such disclosures provide the means for maintaining adequate records of acreage holdings of all such parties where such interests constitute chargeable acreage holdings. An "interest" in the lease or permit includes, but is not limited to, record title interests, overriding royalty interests, working interests, operating rights or options, or any agreements covering such "interests." Any claim or any prospective or future claim to an advantage or benefit from a lease or permit, and any participation or any defined or undefined share in any increments, issues, or which may be derived from or which may accrue in any manner from the lease or permit based upon or pursuant to any agreement or understanding existing at the time when the application is filed, is deemed to constitute an "interest" in such lease or permit.

(b) *Regional mining supervisor.* The Regional Mining Supervisor of the Geological Survey for the region in which the lands under permit or lease are situated.

(c) *Rule of approximation.* The rule of approximation applies where an application embraces an acreage in excess of the acreage limitation; it may be allowed for the excess acreage if exclusion of the smallest legal subdivision involved would result in a deficiency which would be greater than the excess resulting from the inclusion of such subdivision.

§ 3500.1 Minerals subject to leasing.

§ 3500.1–1 Public domain and acquired minerals.

The Mineral Leasing Act, as amended, the Acquired Lands Leasing Act and the Reorganization Act provide for the leasing of deposits of coal; chlorides, sulphates, carbonates, borates, silicates, or nitrates of potassium and sodium; phosphate; native asphalt, solid and semisolid bitumen, and bituminous rock including oil-impregnated rock or sands from which oil is recoverable only by special treatment after the deposit is mined or quarried; sulphur in the States of Louisiana and New Mexico; minerals in acquired lands which would be subject to location under the United States mining laws if located in public domain lands; and for the development of sodium, magnesium, aluminum, or calcium deposits, in any of the forms described and associated with the potassium deposits.

§ 3500.1–2 Reports required.

All reports concerning operations shall be filed with the Mining Supervisor.

§ 3500.1–3 Special acts.

(a) Gold and Silver in Confirmed Private Land Grants.

(b) Asphalt in Oklahoma.

(c) Nevada. (1) Silica sands and other nonmetallics, deposits of phosphate, coal, sodium and potash in lands withdrawn by Executive Order No. 5105 of May 3, 1929.

(2) Sand and gravel in certain lands patented to the State.

(d) Reserved minerals in lands patented to the State of California for park and other public purpose.

(e) Certain National Forest lands in Minnesota. Permits the prospecting, development, and utilization of those mineral resources which because of withdrawal, reservation, statutory limitation, or otherwise, are not subject to the general mining laws, and for the development and utilization for which no other authority exists.

(f) Lake Mead Recreation Area. All minerals subject to the general mining laws and mineral deposits of coal, phosphate, potassium, and sodium.

(g) National Forest Wilderness. All leasing act minerals remain subject to leasing until midnight December 31, 1983.

(h) Whiskeytown-Shasta-Trinity National Recreation Area. Permits the leasing of nonleasable and leasable minerals in the area.

§ 3500.2 Multiple Development.

The granting of a permit or lease for the prospecting, development, or production of deposits of any one mineral will not preclude the issuance of other permits or leases for the same land for deposits of other minerals with suitable stipulations for simultaneous operation, nor the allowance of applicable entries locations, or selections of leased lands with a reservation of the mineral deposits to the United States.

Subpart 3501—Lands Subject to Leasing

§ 3501.1 Public Domain.

§ 3501.1–1 Protection of preexisting rights.

(a) *Potassium.* (1) Section 6 of the act of February 7, 1927, supra, which repealed the act of October 2, 1917 (40 Stat. 297), excepts valid claims existing at the passage of the act and thereafter maintained in compliance with the law under which initiated, which claims may be perfected under such law, including discovery.

(2) As to potassium mining claims, only those claims may be patented which were initiated prior to and were valid existing claims on October 2, 1917, and have since been duly maintained as such.

(b) *Sodium.* Mining claims for deposits described in part 3500 which were valid on February 25, 1920, or on lands in San Bernardino County, Calif., on December 11, 1928, if duly maintained, may be patented under the law under which they were initiated. Otherwise such deposits may be secured only under the Mineral Leasing Act.

(c) *Phosphate.* Mining claims for deposits described in part 3500 which were valid on February 25, 1920, if duly maintained, may be patented under the law under which they were initiated. Otherwise such deposits may be secured only under the Mineral Leasing Act.

(d) *Sulphur.* Mining claims for sulphur deposits on lands such as specified in part 3500 situated in Louisiana which were valid on April 17, 1926, or on such lands in New Mexico, on July 16, 1932, if duly maintained, may be patented under the law under which they were initiated. Otherwise, such deposits may be secured only under the act of April 17, 1926 (44 Stat. 301), as amended July 16, 1932 (47 Stat. 701; 30 U.S.C. 271–276).

§ 3501.1–2 Unsurveyed lands, General.

(a) All prospecting permits may be issued either by metes and bounds description or approved protraction surveys. All leases, preference right or competitive, must be surveyed prior to issuance of a lease.

(b) When protracted surveys have been approved and the effective date thereof published in the Federal Register, all applications to lease lands shown on such protracted surveys, filed on or after such effective date, must describe the lands only according to the section, township, and range shown on the approved protracted surveys.

(1) *Survey for leasing—Applicant's expense.* (*a*) Prior to the issuance of a lease based upon discovery of valuable deposits of potassium, sodium or sulphur, the survey for unsurveyed lands will be at the expense of the applicant.

(*b*) A deposit of the estimated cost of making a survey of the lands as officially determined by the Bureau of Land Management will be required. This survey will be an extension of the public land surveys over the lands applied for, and the lands to be included in the lease will be conformed to the subdivision of such survey.

(2) *Government expense.* Prior to issuance of a lease based upon discovery of coal and on all competitive leases, the survey of unsurveyed lands will be at the expense of the Government.

§ 3501.1–3 Description of lands in offer.

A complete and accurate description of the lands for which the lease is desired is required. The lands in the lease or permit shall be in reasonably compact form entirely within an area of 6 miles square or within an area not exceeding six surveyed or protracted sections in length or width; except for coal cases where noncontiguous tracts can be efficiently worked as a single mine or unit.

(a) *Surveyed lands.* If the lands have been surveyed under the public land rectangular system, each application must describe the lands by legal subdivision, section, township and range.

(b) *Protracted surveys.* When protracted surveys have been approved and the effective date thereof published in the Federal Register, all applications to lease lands shown on such protracted surveys, filed on or after such effective date, must describe the lands only according to the section, township, and range shown on the approved protracted surveys.

(c) *Unsurveyed lands.* If the lands have neither been surveyed on the ground nor shown on the records as protracted surveys, each application must describe the lands by metes and bounds, giving courses and distances between the successive angle points on the boundary of the tract, in cardinal directions except where the boundaries of the lands are in irregular form, and connected by courses and distances to an official corner of the public land surveys. In Alaska the description of unsurveyed lands must be connected by courses and distances to either an official corner of the public land surveys or to a triangulation station established by any agency of the United States (such as the U.S. Geological Survey, the Coast and Geodetic Survey, or the International Boundary Commission), if the record position thereof is available to the general public.

(d) *Unsurveyed public lands adjacent to tidal waters in southern Louisiana and Alaska.* In lease offers embracing unsurveyed public lands adjacent to tidal waters in southern Louisiana and in Alaska, if the offeror finds it impractical to furnish a metes and bounds description, as required in paragraph (c) of this section with respect to the water boundary, he may, at his option, extend the boundary of his offer into the water a distance sufficient to permit complete enclosure of the water boundary of his offer by a series of courses and distances in cardinal directions (the object being to eliminate the necessity of describing the meanders of the water boundary of the public lands included in the offer). The description in the lease offer shall in all other respects conform to the requirements of paragraph (a) of this section. Such description would not be deemed for any purpose to describe the true water boundaries of the lease, such boundaries in all cases being the ordinary high watermark of the navigable waters. The land boundaries of such overall area shall include only the public lands embraced in the offer. The offeror shall agree to pay rental on the full acreage included within the description with the understanding that rights under any lease issued on that offer will apply only to the areas within that description properly subject to lease under the act, but that the total area described will be considered as the lease acreage for purposes of rental payments, acreage limitations § 3100.1–5 and the maximum or minimum area to be included in the lease pursuant to § 3110.1–3. The tract should be shown in outline on a current quadrangle sheet published by the U.S. Geological Survey or such other map as will adequately identify the lands described.

§ 3501.1–4 Acreage limitations.

(a) *Computing acreage holdings.* In computing acreage holdings or control, the accountable acreage of a party owning an undivided interest in a lease or permit shall be such party's proportionate part of the total lease and permit acreage. Likewise, the accountable acreage of a party owning an interest in a corporation or association shall be such party's proportionate part of the corporation's or association's accountable acreage except that no person shall be charged with his pro rata share of any acreage holdings of any association or corporation, unless he is the beneficial owner of more than 10 percent of the stock or other instruments of ownership or control of such association or corporation.

(b) *Allowable acreage.* Except as hereinafter stated, no person, association, or corporation may hold at any one time leases or permits exceeding the acreage as stated below in any one state, except for phosphate in the United States, whether directly through the ownership of such leases and permits, or interest therein, and applications therefor, or indirectly as a member of an association or as a stockholder of a corporation holding such leases and permits, or interest therein, and applications therefor. The rule of approximation applies to all applications for permits and leases.

(1) *Coal* (i) A permit may not exceed 5,120 acres. Holdings in permits and leases shall not exceed 46,080 acres.

(ii) There is no statutory limitation on the acreage that may be included in any one leasing tract. However, the authorized officer after consultation with the mining supervisor of the Geological Survey, will determine the amount of acreage to be included in each leasing tract, taking into consideration the area required for plant facilities and such other data as may be pertinent.

(2) *Potassium.* A lease or permit may not exceed 2,560 acres. Holdings in permits shall not exceed 51,200 acres. Holdings in leases may not exceed 25,600 acres in one or more mining units.

(3) *Sodium.* A lease or permit may not include more than 2,560 acres. Holdings in permits and leases shall not exceed 5,120 acres.

(4) *Phosphate.* A lease or permit may not exceed 2,560 acres. Holdings in leases and permits shall not exceed 20,480 acres in the United States.

(5) *Sulphur.* A lease or permit may not include more than 640 acres. Holdings may not include more than three permits or leases.

(6) *Asphalt.* A lease may not include more than 2,560 acres. Holdings may not include more than 7,680 acres in any one State irrespective of the number of leases.

§ 3501.1–5 Exceptions.

(a) National parks and monuments.

(b) Indian reservations.

(c) Incorporated cities, towns, and villages.

(d) Naval petroleum and oil shale reserves.

(e) Lands acquired under the act of March 1, 1911 (36 Stat. 961; 16 U.S.C. 513-519) known as the Appalachian Forest Reserve Act, or other acquired lands.

§ 3501.1–6 Rejections.

Applications for permits or leases which are filed for lands not available for prospecting or leasing, or which do not comply with the regulations in this part as to acreage limitations and land descriptions will be rejected.

§ 3501.2 Acquired lands.

§ 3501.2–1 Lands and deposits not subject to leasing.

(a) Lands acquired for the development of their mineral deposits.

(b) Lands acquired by forclosure or otherwise for resale.

(c) Lands acquired as surplus under the Surplus Property Act of October 3, 1944 (58 Stat. 765; 50 U.S.C. 1611, et seq.).

(d) Lands in incorporated cities, towns, and villages.

(e) Lands in national parks and monuments.

(f) Lands set apart for military or naval purposes, including lands within the naval petroleum and oil shale reserves.

(g) Lands which are tide lands, submerged coastal lands, within the Continental Shelf adjacent or littoral to any part of land within the jurisdiction of the United States.

§ 3501.2–2 Sale or conveyance of lands.

Any sale or conveyance of lands subject to the act by the agency having jurisdiction thereof, shall be subject to any lease or permit theretofore issued under the act.

§ 3501.2–3 Outstanding permits and leases.

(a) *Acquired lands*—(1) *Leasable minerals.* Coal, phosphate, sodium, potassium, sulphur, or oil shale leases outstanding on August 7, 1947, and which cover lands subject to the act, may be exchanged for new leases to be issued under the act subject, in each case, to such appropriate conditions as may be prescribed.

(2) *Solid (hardrock) minerals.* Prospecting permits and leases, heretofore issued by the Department of Agriculture will be continued to be administered by the Department of the Interior in accordance with the regulations under which they were issued.

§ 3501.2–4 Description of lands in application.

(a) *Surveyed lands.* If the land has been surveyed under the rectangular system of public land surveys, and the description can be conformed to that system, the land must be described by legal subdivision, section, township, and range. Where the description cannot be conformed to the public land surveys, any boundaries which do not so conform must be described by metes and bounds, giving courses and distances between the successive angle points with appropriate ties to the nearest existing official survey corner. If not so surveyed and if within the area of the public land surveys, the land must be described by metes and bounds, giving courses and distances between the successive angle points on the boundary of the tract, and connected with a reasonably nearby corner of those surveys by courses and distances.

(b) *Lands not surveyed under rectangular survey.* (1) If the lands have not been surveyed under the rectangular system of public land surveys, and the tract is not within the area of the public land surveys, it must be described as in the deed or other document by which the United States acquired title to the lands or minerals.

(2) If the desired land constitutes less than the entire tract acquired by the United States, it must be described by courses and distances between successive angle points on its boundary tying by course and distance into the description in the deed or other document by which the United States acquired title to the land.

(3) In addition, if the description in the deed or other document by which the United States acquired title to the lands does not include the courses and distances between the successive angle points on the boundry of the desired tract, the description in the offer must be expanded to include such courses and distances.

(4) Application or offer must be accompanied by a map upon which the desired lands are clearly marked showing their location with respect to the administrative unit or project of which they are a part (such map need not be submitted where the desired lands have been surveyed under the rectangular system of public land surveys, and the land description can be conformed to that system).

(5) If an acquisition tract number has been assigned by the acquiring agency to the identical tract desired, a description by such tract number will be accepted in such offer or application.

(c) *Accreted lands.* Where an offer or application includes any accreted lands that are not described in the deed to the United States, such accreted lands must be described by metes and bounds, giving courses and distances between the successive angle points on the boundry of the tract, and connected by courses and distances to an angle point on th perimeter of the acquired tract to which the accretions appertain.

§ 3501.2–5 Acreage limitations.

(a) *Restrictions on holdings.* The amount of acquired lands acreage that may be held under lease or permit either directly or indirectly, individually or as a member of an association or a corporation may not be in excess of the amount of public domain acreage for the same minerals permitted to be held under the mineral leasing laws. Public domain lease holdings shall not be charged against acquired lands lease holdings; such respective holdings shall not be interchangeable. Where the United States owns only a fractional interest in the mineral resources of the lands involved, only that part of the total acreage involved in the lease which is proportionate to the ownership by the United States of the mineral resources therein shall be charged as acreage holdings. The acreage embraced in a future interest lease is not to be charged as acreage holdings until the lease for the future interest takes effect.

(b) *Allowable acreage*—(1) *Leasable minerals.* See sec. 3501.1–4(b).

(2) *Locatable minerals.* (Minerals other than those subject to the 1920 Act as amended.) (i) No applicant may hold more than 20,480 acres under prospecting permit and lease of which not more than 10,240 acres may be held under lease, provided, however, that the Secretary may authorize a lessee to hold under lease an additional 10,240 acres of land if he finds, upon a satisfactory showing submitted by the lessee that such additional acreage is necessary to promote the orderly development of mineral resources and does not result in undue control of the mineral to be mined, removed and marketed, but in no event shall a lessee hold in excess of 10,240 acres of leased land for the mining of any dominant single mineral, nor shall any person at any one time hold more than 20,480 acres under permit and lease in any one State.

(ii) A prospecting permit may not include more than 2,560 acres, and will be issued to the first qualified applicant. The lands in the permit must be entirely within an area of six miles square or within an area not exceeding six surveyed sections in length or width. An application for a prospecting permit which covers lands that are not located entirely within an area of six miles square or an area of six surveyed sections in length or width will be rejected in its entirety.

§ 3501.2–6 Consent of administering agency.

(a) *Jurisdiction of lands.* Leases or permits may be issued only with the consent of the head or other appropriate official of the executive department, independent establishment or instrumentality having jurisdiction over the lands containing the deposits, or holding a mortgage or deed of trust secured by such lands, and subject to such conditions as that official may prescribe to insure adequate utilization of the lands for the primary purpose for which they were acquired or are being administered. Such consent to prospecting shall not be deemed to vest in the prospector an exclusive right to exploration or a preference right to a lease under this part.

(b) *Jurisdiction of surface.* Where the United States has conveyed the title to, or otherwise transferred the control of the surface of the lands containing the deposits to any State or any political subdivision, agency or instrumentality thereof, or a college or any other educational corporation, or association, or a charitable or religious corporation or association, such party shall be given written notification by certified mail of the application for the permit or lease, and shall be afforded a reasonable period of time within which to suggest any stipulations deemed by it to be necessary for the protection of existing surface improvements or uses to be included in the permit or lease, setting forth the facts supporting the necessity thereof, and also to file any objections it may have to the issuance thereof. Where such party opposes the issuance of the permit or lease, the facts submitted in support must be carefully considered and each case separately decided on its merits. However, such opposition affords no legal basis or authority to refuse to issue the permit or lease for the reserved minerals in the lands; in such case, the final determination whether to issue the permit or lease depends upon whether the interests of the United States would best be served thereby.

(c) *Identification of administering agency.* All applications and offers for permits or leases should name if practicable, the Government agency from which consent to issuance of a permit or lease must be obtained, or the agency that may have title records covering the ownership of the mineral interest involved, and identify the project, if any, of which the land is a part. Permits or leases to which such consent is necessary will not be issued until the lessee or permittee executes such stipulations as may be required by the consenting agency.

(d) *Right to stipulate.* Lands under jurisdiction of the Department of Agriculture. The Reorganization Plan and the Acts provide that mineral development may be permitted only with the consent of the Secretary of Agriculture and subject to such conditions as he may prescribe to protect the purposes for which the lands were acquired or are being administered. An application will be rejected if the Secretary of Agriculture does not give his consent. Any lease permit, or other instrument granting the right to mine or remove the minerals will contain such stipulations as may be specified by that official in order to protect such purposes. All matters relating to the surface of the land and its protection, including responsibility for securing compliance with all applicable regulations and procedures of the Department of Agriculture, the terms of the lease relating to the surface and surface resources, and the stipulations specified for the protection of the land, are functions of the Department of Agriculture. Lessees and permittees will comply with the applicable regulations of the Secretary of Agriculture and will consult with the authorized representative of the Secretary of Agriculture as to matters relating to the surface.

§ 3501.2–7 Lands subject to leasing.

(a) In acquired lands under the act of March 4, 1917 (39 Stat. 1134, 1150; 16 U.S.C. 520), Title II of the National Industrial Recovery Act of June 16, 1933 (48 Stat. 195, 200, 202, 205; 40 U.S.C. 401, 403(a) and 408), the 1935 Emergency Relief Appropriation Act of April 8, 1935 (49 Stat. 115, 118), section 55 of Title I of the act of August 24, 1935 (49 Stat. 750, 781), the act of July 22, 1937 (50 Stat. 522, 525, 530), as amended July 28, 1942 (56 Stat. 725; 7 U.S.C. 1011(c) and 1018).

(b) In acquired lands, except Indian lands and lands in national parks and monuments, under the jurisdiction of the bureaus of the Department of the Interior where authorized by law.

(c) In those lands added to the Shasta National Forest by the act of March 19, 1948 (62 Stat. 83), which were acquired with funds of the United States, or lands received in exchange therefor.

(d) In those portions of the Juan Jose Lobato Grant (North Lobato tract) and of the Anton Chica Grant (El Pueblo tract) in New Mexico, mentioned in paragraph (c) of this section.

§ 3501.3 Withdrawn, reserved or segregated.

§ 3501.3–1 Lands and deposits not subject to leasing.

See §§ 3501.1–5 and 3501.2–1.

§ 3501.3–2 Consent of administrator.

(a) *Requirements when lands are in a withdrawal.* Where any part of the lands embraced in an application for lease, permit or license is within a withdrawal which does not preclude disposition of the deposits, the head of the Government agency having control will be called upon for a report as to whether there is any objection to the granting of a lease, permit or license. In cases where such agency recommends that a special stipulation be furnished by the applicant to protect the interest of the United States, an appropriate stipulation will be included in the lease, permit or license.

(b) *Requirements when lands are reserved or segregated.* (1) General statement. With respect to lands embraced in a reservation or segregated for any particular purpose the lessee shall conduct operations in conformity with such requirements as may be made by the Bureau of Land Management for the protection and use of the land for the purpose for which it was reserved or segregated, so far as may be consistent with the use of the land for the purpose of the lease, which latter shall be regarded as the dominant use unless otherwise provided or separately stipulated.

(2) Lands disposed of with a reservation of minerals. Where the lands included in a permit, lease or license have been or may be disposed of with reservation of the deposits, a permittee, lessee or licensee must make full compliance with the law under which reservation was made.

(i) *Coal.* See the acts of March 3, 1909 (35 Stat. 844; 30 U.S.C. 81); June 22, 1910 (36 Stat. 583, 30 U.S.C. 83–85); December 29, 1916 (39 Stat. 862; 43 U.S.C. 291–301; June 17, 1949 (63 Stat. 200); June 21, 1949 (63 Stat. 214; 30 U.S.C. 54); March 8, 1922 (42 Stat. 415; 48 U.S.C. 377); and other laws authorizing such reservation.

(ii) *Potassium.* See the acts of July 17, 1914 (38 Stat. 509; 30 U.S.C. 121–123); December 29, 1916 (39 Stat. 862; 43 U.S.C. 291–301); June 17, 1949 (63 Stat. 201); June 21, 1949 (63 Stat. 215; 30 U.S.C. 54); and August 13, 1954 (68 Stat. 708); and other laws authorizing such reservations.

(iii) *Sodium.* See the Acts of July 17, 1914 (38 Stat. 509; 30 U.S.C. 121–123); December 29, 1916 (39 Stat. 862; 43 U.S.C. 291–301); June 17, 1949 (63 Stat. 201); June 21, 1949 (63 Stat. 215; 30 U.S.C. 54); and August 13, 1954 (68 Stat. 708); and other laws authorizing such reservations.

(iv) *Sulphur.* Where lands included in a permit or lease have been disposed of with reservation of sulphur deposits, a permittee or lessee must make full compliance with the law under which such reservation was made. See the Acts of March 4, 1933 (47 Stat. 1570; 30 U.S.C. 124); December 29, 1916 (39 Stat. 862; 43 U.S.C. 291–301); June 17, 1949 (63 Stat. 201); June 21, 1949 (63 Stat. 215; 30 U.S.C. 54); and August 13, 1954 (68 Stat. 708); and other laws authorizing such reservations.

(v) *Asphalt in Oklahoma.* See the Act of February 19, 1912 (37 Stat. 67), and the Act of August 3, 1955 (69 Stat. 445), and the regulations thereunder in Subpart 2781 of this chapter.

(c) *Special Stipulations.* Applicants for permits, leases, and licenses for lands, the surface control of which is under the jurisdiction of the Department of Agriculture, will be required to consent to the inclusion therein of the stipulation on a form approved by the Director. Where the lands have been withdrawn for reclamation purposes the offeror or applicant will be required to consent to the inclusion of a stipulation on the approved forms. If the land is potentially irrigable, or if the land is within the flow limits of a reservoir site or within the drainage area of a constructed reservoir, or if withdrawn for power purposes, or where the lands have been withdrawn as Game Range Lands, Coordination Lands, or Alaska Wildlife Areas, the offeror or applicant will be required to consent to the inclusion of a stipulation on an approved form. Additional conditions may be imposed to protect the land withdrawn if deemed necessary by the agency having jurisdiction over the surface.

§ 3501.3–3 Transfer of surface control.

Where the United States has conveyed the title to, or otherwise transferred the control of the surface of the lands containing the deposits to any State or any political subdivision, agency or instrumentality thereof, or a college or any other educational corporation, or association, or a charitable or religious corporation or association, such party shall be given written notification by certified mail of the application for the permit or lease, and shall be afforded a reasonable period of time within which to suggest any stipulations deemed by it to be necessary for the protection of existing surface improvements or uses to be included in the permit or lease, setting forth the facts supporting the necessity thereof, and also to file any objections it may have to the issuance thereof. Where such party opposes the issuance of the permit or lease, the facts submitted in support must be carefully considered and each case separately decided on its merits. However, such opposition affords no legal basis or authority to refuse to issue the permit or lease for the reserved minerals in the lands; in such case, the final determination whether to issue the permit or lease depends upon whether the interests of the United States would best be served thereby.

§ 3501.4 Special leasing acts.

§ 3501.4–1 Lands and deposits subject to prospecting and leases.

See subpart 3560.

§ 3501.4–2 Consent of administrator.

See subpart 3560.

Subpart 3502—Qualification Requirements

§ 3502.1 General.

Every applicant for a permit or lease must show that, with the area applied for, his or its interest or interests in such permits, leases and applications therefor, directly or indirectly, do not exceed in the aggregate the acreage limitation in § 3501.1-4.

§ 3502.1-1 Who may hold interests.

Mineral prospecting permits and mineral leases may be issued only to (a) citizens of the United States; (b) associations of such citizens organized under the laws of the United States or of any State thereof, which are authorized to hold such interests by the statute under which organized and by the instrument establishing the association; (c) corporations organized under the laws of the United States or of any State thereof; including a company or corporation operating a common-carrier railroad, and to municipalities. (a) *Aliens*. Aliens may not acquire or hold any direct or indirect interest in permits or leases, except that they may own or control stock in corporations holding permits or leases if the laws of their country do not deny similar or like privileges to citizens of the United States. If any appreciable percentage of the stock of a corporation is held by aliens who are citizens of a country denying similar or like privileges to U.S. citizens, its application will be denied.

(b) *Minors*. A mineral lease or permit will not be issued to a minor but leases or permits may be issued to a legal guardian or trustee in his behalf. See § 3502.8.

(c) *Common carrier railroad*. Every company or corporation operating a common-carrier railroad must make a statement that it needs the coal for which it seeks a permit or lease for its own use for railroad purposes; that it operates main or branch lines in the State in which the lands involved are located; that the aggregate acreage in the permits, leases and applications therefor in which it is interested directly or indirectly does not exceed 10,240 acres; and that it does not hold more than one permit or lease for each 200 miles of its railroad lines served or to be served from such coal deposits exclusive of spurs or switches and exclusive of branch lines built to connect the leased coal with the railroad, and also exclusive of parts of the railroad operated mainly by power produced otherwise than by steam.

§ 3502.1-2 Bona fide purchasers.

(a) *Provisions of statute*. The Act of September 21, 1959 (73 Stat. 571), as amended by the Act of September 2, 1960 (74 Stat. 781; Public Law 86-705), provides that the right to cancel or forfeit for violation of any of the provisions of this Act shall not apply so as to affect adversely the title or interest of a bona fide purchaser of any lease, option to acquire a lease or an interest therein, or permit which lease, interest, option, or permit was acquired and is held by a qualified person, association, or corporation in conformity with those provisions, even though the holdings of the person, association, or corporation from which the lease, interest, option, or permit was acquired, or of his predecessor in title (including the original lessee of the United States) may have been cancelled or forfeited or may be or may have been subject to cancellation or forfeiture for any such violation.

(b) *Sale of underlying interests*. If in any proceeding to cancel or forfeit a lease, interest in a lease, option to acquire a lease or an interest therein, or a permit acquired in violation of any of the provisions of this Act, an underlying lease, interest, option, or permit is cancelled or forfeited to the Government and there are valid interests therein or valid options to acquire the lease or an interest therein which are not subject to cancellation, forfeiture, or compulsory disposition, such underlying lease interest, option, or permit shall be sold to the highest responsible, qualified bidder by competitive bidding in a manner similar to that provided for in the offering of leases by competitive bidding subject to all outstanding valid interests therein and valid options pertaining thereto. However, if less than the whole interest in the lease, interest, option, or permit is cancelled or forfeited, such partial interest shall likewise be sold in similar manner. If no satisfactory offer is obtained as a result of the competitive offering of such whole or partial interests, such interests may be sold by such other methods as the authorized officer deems appropriate, but on terms not less favorable to the Government than those of the best competitive bid received.

(c) *Right to dismissal*. Effective as of September 21, 1959, any party to any proceedings with respect to a violation of any provision of the Act, whether initiated prior or subsequent to that date, has the right to be dismissed promptly as such a party by showing that he holds and acquired the interest involving him as a bona fide purchaser without having violated any provisions of the Act. No hearing shall be necessary upon such showing unless prima facie evidence is presented to indicate a possible violation on the part of the alleged bona fide purchaser.

(d) *Suspension*. If during any such proceeding a party thereto files a waiver of his rights under his lease to drill or to assign his interest thereto, or if such rights are suspended by order of the Secretary pending a decision, payments of rentals and the running of time against the term of the lease or leases involved shall be suspended as of the first day of the month following the filing of the waiver or the Secretary's suspension until the first day of the month following the final decision in the proceeding or the revocation of the waiver for suspension.

§ 3502.1-3 Where filed.

(a) *Land office*. All applicants must file their statements of qualification and evidence thereto in the proper land office unless previously filed, in which event a reference by serial number to the record and the land office in which filed, together with a statement as to any amendments, will be accepted.

(b) *Exception*. If applicant is an individual he must submit with each application a statement of his citizenship. See § 3502.2-1.

§ 3502.2 Individuals.

§ 3502.2-1 Statement of citizenship.

If applicant is an individual, he must submit with each application for permit or lease a statement over his own signature setting forth the applicant's citizenship.

§ 3502.2-2 Equitable rights affecting certain coal lands in Oklahoma.

(a) ***Requirements***. Prior to the act of February 25, 1920 equitable rights of persons who, prior to February 25, 1920, occupied and improved or claimed coal lands in good faith may be recognized in awarding leases of such lands.

(b) *Preference right*. A holder of a lease or permit, including a lease under temporary extensions, outstanding on May 24, 1949, covering certain coal lands or coal deposits in Oklahoma which the Choctaw and Chickasaw Nations agreed to convey to the United States in a contract ratified by the act of June 24, 1948 (62 Stat. 596), who has maintained or acted diligently to maintain the lease or permit in good standing, may obtain a lease for the same lands or deposits without competitive bidding, provided that he files an application for a lease under this part prior to the expiration date of the current lease.

§ 3502.3 Associations including partnerships.

§ 3502.3-1 Statements.

(a) If an applicant for a permit or lease is an association (including a partnership), it must submit a certified copy of the articles of association and a statement as to their citizenship and holdings as required of an individual.

(b)(1) If the offeror is an association which meets the requirements of § 3502.-1-1 of this chapter, the offer shall be accompanied by a certified copy of its articles of association or partnership, together with a statement showing (i) that it is authorized to hold leases; (ii) that the member or partner executing the lease is authorized to act on behalf of the association in such matters; and (iii) the names and addresses of all members owning or controlling more than 10 percent of the association. A separate statement from each person owning or controlling more than 10 percent of the association, setting forth his citizenship and holdings, shall also be furnished.

(2) If the offer is made by an association which does not meet the requirements of § 3502.1-1 of this chapter the same showing as to citizenship and holdings of its members shall be made as is required of an individual.

§ 3502.3-2 Evidence previously filed.

Where articles of association, including partnership agreements, have previously been filed pursuant to regulations in this section, a reference by serial number to the record in which such evidence has previously been filed, together with a statement as to any amendments thereof will be accepted.

§ 3502.4 Corporations.

§ 3502.4–1 Statements.

(a) If the applicant is a corporation, it must submit statements showing (1) the state in which it is incorporated; (2) that it is authorized to hold leases for mineral deposits, (3) names of the officers authorized to act in such matters in behalf of the corporation; (4) the precentage of the corporation voting stock and all of the stock owned by aliens or those having addresses outside of the United States; and (5) the name, addresses, citizenship, and acreage holdings of any stockholder owning or controlling 10 percent or more of the corporate stock of any class. If more than 10 percent of the stock is owned or controlled by or on behalf of aliens, or persons who have addresses outside of the United States, the corporation must give their names and addresses, the amount and class of stock held by each, and to the extent known to the corporation or which can be reasonably ascertained by it, the facts as to the citizenship of each.

(b) Exceptions.

(1) Requirements for alien interests or persons having addresses outside of the United States. Regulations for potassium, sodium, sulphur and asphalt in Oklahoma state that if more than 10 percent of the stock is owned or controlled by or on behalf of aliens or persons who have addresses outside of the United States, additional qualifications may be required.

§ 3502.5 Guardian or trustee.

§ 3502.5–1 Statements.

(a) Where there is a legal guardian or trustee: A certified copy of the court order authorizing the guardian or trustee to act as such and to fulfill in behalf of the minor or minors all obligations of the lease or arising thereunder; statements by the guardian or trustee as to the citizenship and holdings of each of the minors and as to his own citizenship and holdings, including his holdings for the benefit of other minors similar to that required by § 3502.8.

§ 3502.5–2 Evidence previously filed.

Where evidence of the authority to act of a guardian, trustee, an executor or administrator, have previously been filed pursuant to the regulations in this section, a reference by serial number to the record in which such evidence has previously been filed, together with a statement as to any amendments thereof will be accepted.

§ 3502.6 Attorney-in-fact.

§ 3502.6–1 Statements.

(a) *Evidence required.* (1) All applications must be signed by the applicant or his attorney-in-fact, and if executed by an attorney-in-fact must be accompanied by the power of attorney and the applicant's own statement as to his citizenship and acreage holdings unless the power of attorney specifically authorized and empowers the attorney-in-fact to make such statement or to execute all statements which may be required under these regulations.

(2) Applications on behalf of a corporation must be accompanied by proof of the signing officer's authority to execute the instrument.

(3) Except in a case where an officer of a corporation signs an application on behalf of the corporation, as to which see § 3502.4 evidence of the authority of the attorney in fact to sign the application and permit, if the application is signed by such attorney on behalf of the applicant.

§ 3502.6–2 Evidence previously filed.

Where such power of attorney has been filed in the same land office where the application is filed reference thereto by serial number of the record in which it has been filed may be made upon the filing of subsequent applications.

§ 3502.7 Showing as to sole party in interest.

Every applicant for lease or permit must submit at the time of filing a signed statement that he is the sole party in interest in the application and the lease or permit, if issued; if not, he shall set forth the names of the other interested parties. If there are other interested parties in the application, a separate or joint statement must be signed by them and by the applicant setting forth the nature and extent of the interest of each in the application, the nature of the agreement between them, if oral, and a copy of such agreement if written. Such separate or joint statement of interest and written agreement, if any, or a statement of the nature of such agreement, if oral, must accompany the application. Simultaneously, all interested parties must furnish evidence of their qualifications to hold such lease interest or permit.

§ 3502.8 Heirs and devisees (estates).

§ 3502.8–1 General.

If an applicant for a permit, an applicant for a preference right lease, or a successful bidder to a competitive lease dies before the permit or lease is issued, the permit or lease will be issued to the executor or administrator of the estate if probate of the estate has not been completed; if probate has been completed, or is not required, to the heirs or devisees; and if there are minor heirs or devisees, to their legal guardian or trustee in his name, provided there is filed in all cases the following information:

(a) *Probate not completed.* Where probate of the estate has not been completed:

(1) *Evidence to sign.* Evidence that the person, who as executor or administrator submits forms of lease and bond, has authority to act in that capacity and to sign such forms.

(2) *Evidence of heirship.* Evidence that the heirs or devisees are the heirs or devisees of the deceased permittees and are the only heirs or devisees of the deceased.

(3) *Evidence as to citizenship and holdings.* A statement over the signature of each heir or devisee concerning citzenship and holdings similar to that required by §§ 3502.1 and 3502.2–1.

(b) *Probate proceedings not required.* Where the executor or administrator has been discharged or no probate proceedings are required.

(1) Evidence of will or decree of distrbiuton. A certified copy of the will or decree of distribution, if any, and if not, a statement signed by the heirs that they are the only heirs of the permittees and citing the provisions of the law of the deceased's last domicile showing that no probate is required.

(2) A statement over the signature of each of the heirs or devisees with reference to citizenship and holdings similar to that required by §§ 3502.1 and 3502.2–1 except that if the heir or devisee is a minor, the statement must be over the signature of the guardian or trustee.

§ 3502.9 Municipality.

§ 3502.9–1 Coal.

(a) Evidence required. A municipality must submit evidence of: (1) The manner in which it is organized; (2) that it is authorized to hold a permit or lease; and (3) that the action proposed has been duly authorized by its governing body. Where such material has previously been filed a reference by serial number to the record in which it has been filed, together with a statement as to any amendments, will be accepted.

Subpart 3503—Fees, Rentals, and Royalties

§ 3503.0–3 Authorities.

Fees—Act of August 31, 1951 (5 U.S.C. 140). Rentals see § 3500.0–3.

§ 3503.1 Payments.

§ 3503.1–1 Form of remittance.

Remittances must be submitted as cash, money order, check, certified check, bank draft or bank cashier's check.

§ 3503.1–2 Where remitted.

(a) *Proper land office.* Unless otherwise directed by the Secretary, rentals under all leases and permits issued under the act shall be paid to the Manager of the appropriate Land Office. All remittances to Bureau of Land Management offices shall be made payable to the Bureau of Land Management.

(b) *Geological Survey.* Rentals and royalties on producing mining leases are to be paid to the Regional Mining Supervisor. All remittances to Survey offices shall be made payable to the U.S. Geological Survey.

§ 3503.1–3 When remitted.

First year rental must be remitted at the time of filing applications for prospecting permits and preference right leases. First year rental for competitive leases will be required by decision. Thereafter, rental for all prospecting permits and leases will be required in accordance with permit and lease provisions. Applications for extension of permits must be accompanied by annual rental payment.

§ 3503.2 Fees.

§ 3503.2–1 General statement.

Applications for prospecting permits, leases or licenses, extension of permits,

renewals, modifications, and for approval of any instrument transferring a lease or permit or interest therein, must be accompanied by a filing fee of $10 for each application. Such a fee will be retained as a service charge even though an application should be rejected or withdrawn in whole or in part. An application not accompanied by the filing fee will not be accepted.

§ 3503.2–2 Exceptions.

(a) No filing fee required for coal licenses to relief agencies.

(b) Preference right lease applications.

§ 3503.3 Rentals and royalties.

§ 3503.3–1 General statement rentals.

(a) *Permits (Prospecting)*. A prospecting permit application must be accompanied by full payment of the first year's rental at the rate of 25 cents per acre or fraction thereof, but no less than $20 per year, the rental payment to be for the total acreage if known, and if not known, for the total acreage computed on the basis of 40 acres for each smallest subdivision. Thereafter, payment of the annual rental shall be made on or before the anniversary date of the permit.

(b) *Leases*—(1) *Coal.* Annual rental per acre or fraction thereof for coal leases shall be not less than 25 cents for the first year, not less than 50 cents for the second, third, fourth, and fifth years, and not less than $1 for each and every year thereafter during the continuance of the lease. The rental paid for any year shall be credited against the royalties for that year.

(2) *Phosphate.* Annual rental for phosphate leases shall be not less than 25 cents per acre or fraction thereof for the first year, not less than 50 cents for the second and third years, and not less than $1 for each and every year thereafter during the continuance of the lease. The rental paid for any year shall be credited against the royalties for that year.

(3) *Potassium and sodium.* Rental for potassium and sodium leases is 25 cents per acre or fraction thereof for the first calendar year or fraction thereof. Rental for succeeding years is payable on or before January 1, the beginning of the calendar year. Annual rental per acre or fraction thereof is 50 cents for the second, third, fourth, and fifth years, and $1 for the sixth and each succeeding year during the continuance of the lease. The rental for any year will be credited against the first royalties as they accrue under the lease during the year for which rental was paid.

(4) *Sulphur.* Sulphur leases shall provide for payment, in advance, of an annual rental of 50 cents for each acre or part thereof covered by the lease, beginning with the date of the lease, such rental for any year to be credited against the first royalties as they accrue under the lease during the year for which the rental was paid.

(5) *Asphalt.* The annual rental will be 50 cents per acre or fraction thereof payable annually in advance.

(6) *Solid (hardrock) minerals.* An application for preference right lease must be accompanied by a rental payment of $1 for each acre or fraction thereof included in the application, but not less than $20. In no event shall the first year's rental on any lease be less than $20.

(c) *Use permits.* The annual rental for a sodium or phosphate use permit will be not less than $1 per acre or fraction thereof.

(d) *Licenses.* No rental payment required.

§ 3503.3–2 General statement royalties.

(a) *Royalty on production.* Royalty rates will be determined on an individual case basis prior to lease issuanue. Such rates will be set out in the notice of competitive lease offer.

(1) *Exceptions*—(i) *Sulphur.* Leases based upon discovery of valuable sulphur deposits under a sulphur permit shall provide for a royalty of 5 percent of the quantity or gross value of the output of sulphur at the point of shipment to market. Leases for lands known to contain valuable deposits of sulphur and not covered by sulphur permits or leases shall provide for such royalty as will be determined prior to the issuance of the lease, but in no case shall the royalty be less than 5 percent of the quantity or gross value of the output of sulphur at the point of shipment to market.

(ii) *Solid (hardrock) minerals.* The terms and conditions of the lease, including the royalty rates, will be established on an individual case basis. If minerals other than that specified in the issued lease should be discovered and mined by the lessee, an applicable royalty rate will be established by the lessor for such mineral.

(b) *Minimum royalty*—(1) Coal. Leases shall be conditioned upon the payment of a royalty on a minimum annual production beginning with the sixth year of the lease, except when operation is interrupted by strikes, the elements, or casualties not attributable to the lessee, unless, on application and showing made, operations shall be suspended when market conditions are such that the lease cannot be operated except at a loss or for the other reasons specified in section 39 of the act (see sec. 3503.3–2(e)). Operations under the lease shall be continuous except in the circumstances described or unless the lessee shall pay a royalty, less rent, on the minimum production for one year in advance, in which case operations may be suspended for that year.

(i) *Exception. (a) Certain coal lands in Oklahoma.* In the case of an award of a lease to a qualified person the royalties will be established at rates not less than the minimum provided for leases under the act.

(2) *Potassium, sodium and sulphur.* Leases will require the payment of a royalty on a minimum annual production beginning with the sixth full calendar lease year, unless operations are interrupted by strikes, the elements, or casualties not attributable to the lessee, or unless, on application and showing made, lease operations are suspended by the Department of the Interior for the reasons specified in section 39 of the Mineral Leasing Act (30 U.S.C. 209).

(3) *Phosphate.* (i) *Minimum production.* Each lease will contain appropriate conditions fixing a minimum annual production of the leased deposits beginning with the fourth year from date thereof or payment of a minimum royalty in lieu thereof, except when production is interrupted by strikes, the elements, casualties not attributable to the lessee, or upon a satisfactory showing that market conditions are such that the lessee cannot operate except at a loss. When authorized in the lease the minimum production requirements may be satisfied by production from other properties controlled by the lessee and constituting a necessary reserve so located as to be a part of a successful unit operation.

(ii) *Lessee's petition for change in minimum production.* The lessee may request at any time prior to the end of the thirtieth lease month, that the Secretary reduce the amount of the minimum production specified in the lease upon the basis of the showing submitted by the lessee. The petition must be filed in duplicate with the office from which his lease was delivered. It should give, among other relevant information, (a) his estimate of tonnage of mineral phosphate rock and associated or related minerals in the leased land, (b) all available information as to the grade thereof, (c) his plan of operation for the property and adjacent property to be worked therewith, (d) a general statement of the method or methods which he intends to use in mining and processing of the phosphate rock and associated or related minerals, (e) the estimated rate of its extraction and (f) possible absorption in the markets. Within 6 months after receipt of this information the authorized officer, after considering what would be a reasonable period within which to mine the leased deposits taking into account, where material, the lessee's mining operations on adjacent phosphate land owned or controlled by him, will determine whether the minimum production requirement in the lease shall be changed to a lesser figure than the amount then provided.

(c) *Limitation of overriding royalties.* (1) An overriding royalty interest may be created by assignment or otherwise: *Provided, however,* That if the total of the overriding royalty interest at any time exceeds one percent of the gross value of the output at the point of shipment to market, it shall be subject to reduction or suspension by the Secretary to a total of not less than one percent of such gross value, whenever, in the interest of conservation, it appears necessary to do so in order (1) to prevent premature abandonment, or (2) to make possible the economic mining of marginal or low grade deposits. Where there is more than one overriding royalty interest, any such suspension or reduction shall be applied to the respective interests in the manner agreed upon by the holders thereof or in the absence of such argeement, in the inverse order of the dates of creation of such interests.

(2) Any assignment, sublease, or other transfer or agreement which creates an overriding royalty interest, will not be approved unless the owner of that interest files his agreement in writing that such interest is subject to suspension or reduction as provided in paragraph (1) of this section. No overriding royalties shall be paid at a rate in excess of the rate to which they have been so reduced until otherwise authorized by the Secretary.

(3) *Exceptions.* (i) *Coal.* An overriding royalty interest shall not be created by assignment or otherwise exceeding 50 percent of the rate of royalty first payable to the United States under the lease or an overriding royalty interest which when added to any other overriding royalty interest exceeds that percentage, excepting that where an interest in the leasehold, permit, or operating agreement is assigned, the assignor may retain an overriding royalty interest in excess of the above limitation if he shows to the satisfaction of the Bureau of Land Management, that he had made substantial investments for improvements on the land covered by the assignment.

(ii) *Phosphate.* An overriding royalty interest shall not be created by assignment or otherwise exceeding one percent of the gross value of the output at point of shipment to market or an overriding royalty interest which when added to any other overriding royalty interest exceeds that percentage, excepting that where an interest in the leasehold, permit, or operating agreement is assigned, the assignor may retain an overriding royalty interest in excess of the above limitation if he shows to the satisfaction of the authorized officer that he has made substantial investments for improvements on the land covered by the assignment.

(d) *Waiver, suspension, or reduction of rental or minimum royalty.* (1) In order to encourage the greatest ultimate recovery of coal, phosphate, potassium, sodium, and sulphur, and in the interest of conservation, the Secretary of the Interior whenever he determines it necessary to promote development or finds that the leases cannot be successfully operated under the terms provided therein may waive, suspend, or reduce the rental or minimum royalty or reduce the royalty on an entire leasehold, or on any deposit, tract, or portion thereof segregated for royalty purposes.

(2) An application for any of the above benefits shall be filed in triplicate in the office of the mining supervisor for coal, phosphate, potassium, sodium, and sulphur leases. It must contain the serial number of the leases, the land office name, the name of the record title holder and operator or sublessee and the description of the lands by legal subdivision.

(i) Each application involving coal, phosphate, potassium, sodium and sulphur shall show the number and location of each mine, a map showing the extent of the mining operations, a tabulated statement of the minerals mined and subject to royalty for each month covering a period of not less than 12 months next prior to the date of filing of the application, and the average production per day mined for each month and complete information as to why the minimum production was not attained.

(ii) Every application must contain a detailed statement of expenses and costs of operating the entire lease, the income from the sale of any leased products, and all facts tending to show whether the mines can be successfully operated upon the royalty or rental fixed in the lease. Where the application is for a reduction in royalty full information shall be furnished as to whether royalties or payments out of production are paid to others than the United States, the amounts so paid and efforts made to reduce them.

(iii) The applicant must also file agreements of the holders of the lease and of the royalty holders to a permanent reduction of all other royalties from the leasehold to aggregate not in excess of one-half the Government royalties.

(e) *Suspension of operations and production.* (1) Applications by lessees for relief from the producing requirements or from all operating and producing requirements of mineral leases shall be filed in triplicate in the office of the Regional Mining Supervisor for all leases. By Departmental Order No. 2699 and Geological Survey Order No. 218 of August 11, 1952, the Regional Mining Supervisor is authorized to act on applications for suspension of operations or production or both filed pursuant to this section and to terminate suspensions of this kind which have been or may be granted.

(2) The term of any lease will be extended by adding thereto any period of suspension of all operations and production during such term pursuant to any direction or assent of the Secretary.

(3) A suspension shall take effect as of the time specified in the direction or assent of the Secretary. Rental and minimum royalty payments will be suspended during any period of suspension of all operations and production directed or assented to by the Secretary, beginning with the first day of the lease month on which the suspension of operations and production becomes effective or, if the suspension of operations and production becomes effective on any date other than the first day of a lease month, beginning with the first day of the lease month following such effective date. The suspension of rental and minimum royalty payments shall end on the first day of the lease month in which operations or production is resumed. Where rentals are creditable against royalties and have been paid in advance, proper credit will be allowed on the next rental or royalty due under the lease.

(4) No lease shall be deemed to expire by reason of a suspension of either operations or production only, pursuant to any direction or assent of the Secretary.

(5) The minimum annual production requirements of a lease issued under the act for coal, phosphate, potassium, sodium, or sulphur shall be proportionately reduced for that portion of a lease year for which suspension of operations and production is directed or granted by the Secretary of the Interior in the interest of conservation.

(6) *Exceptions.* (i) *Solid (hardrock) minerals.* (*a*) Upon a showing of the need and upon application therefor, filed in triplicate in the office of the Regional Mining Supervisor and a copy filed in the proper land office, the lessee may be granted a suspension of the operating and/or producing requirements of the lease. A rental in lieu of royalty of not less than $1 per acre shall be paid annually during the period of suspension. The period of suspension shall be specified in an appropriate order of the Secretary or his authorized representative.

(*b*) Notwithstanding the provisions of the preceding paragraph, the Secretary, in the interest of conservation of natural resources, may suspend all operating and producing requirements and waive, suspend, or reduce the rental or minimum royalty.

Subpart 3504—Bonds

§ 3504.1 General.

§ 3504.1–1 Statement.

Bonds shall be either corporate surety bonds or personal bonds except that bonds with individual sureties as provided in § 3504.3 may be furnished for the protection of the entryman or owner of surface rights.

§ 3504.1–2 Special acts.

(a) *Gold and silver in confirmed private land grants.* A bond with approved corporate surety in the sum of $2,000 will be required as a guarantee to the making of the investment fixed in the lease and compliance with the other terms and conditions thereof, but a larger bond may be fixed if that amount is determined to be inadequate for the purpose for which given.

(b) *Asphalt in Oklahoma.* A compliance bond in no event less than $1,000 will be required prior to issuance of the lease and compliance with § 3504.2–1(b).

(c) *Nevada*—(1) *Silica sands and other nonmetallic minerals in certain areas in Nevada.* The applicant will be required prior to the issuance of the lease to furnish and maintain thereafter a bond with acceptable corporate surety, or two qualified individual sureties, in the sum of $1,000 or such other amount as may be fixed, conditioned against failure of the lessee to comply with the provisions of the lease.

(2) *Sand and gravel in certain lands patented to the State.* The applicant will be required prior to issuance of the lease to furnish and maintain thereafter a bond with acceptable corporate surety, or two qualified individual sureties, in the sum of $1,000 or such other amount as may be fixed, conditioned against failure of the lessee to comply with the provisions of the lease, and for the protection of the owner of the surface estate from damages resulting from the operation of such lessee.

(d) *Reserved minerals in lands patented to the State of California for park or other public purposes.* Each lessee will be required to furnish a bond in such sum as may be determined adequate, in no case less than $1,000, to insure compliance with the terms of the lease and for the protection of the surface owner.

(e) *Certain national forest lands in Minnesota.* There must be filed a bond in compliance with § 3504.2-1(a)(1) for permits; and § 3504.2-1(b) for leases.

(f) *Lease for minerals on lands withdrawn for reclamation purposes within Lake Mead Recreation area.* There must be filed a bond in compliance with § 3504.2-1(b) for leases.

(g) *Prospecting and mineral leasing within National Forest Wilderness.* There must be filed a bond in compliance with § 3504.2-1(a)(1) for permits; and § 3504.2-1(b) for leases.

(h) *Development of minerals in lands within Whiskeytown-Shasta-Trinity national recreation area.* There must be filed a bond in compliance with § 3504.2-1(a)(1) for permits; and § 3504.2-1(b) for leases.

§ 3504.2 Type of bond.

§ 3504.2-1 Compliance bonds.

(a) *Permit bond*—(1) *Amount.* The applicant must furnish a bond conditioned upon compliance with all terms of the prospecting permit on all permits issued pursuant to applications filed under this section. The bond shall be in the amount determined by the authorized officer, but not for less than $1,000.

(2) *Exception*—(i) *Solid (Hardrock) minerals.* The permittee may also be required, as condition precedent to the issuance of a permit, to furnish a permit bond.

(b) *Lease bond*—(1) *Amount.* A bond conditioned upon compliance with all the provisions of the lease must be furnished on all leases issued. The bond shall be in the amount determined by the authorized officer but in no event less than $5,000 for potassium, sodium, phosphate and sulphur leases; not less than $1,000 for coal leases; and not less than $500 for solid (hardrock) mineral leases. The right is reserved to increase the amount of the bond when deemed proper by the authorized officer.

§ 3504.2-2 Where filed and copies.

Bonds must be filed in the proper land office in a single original copy.

§ 3504.2-3 When filed.

Permit bonds may be filed with an application which will expedite action thereon; or bonds may be filed within 30 days after receipt of notice by the applicant of the bond requirement.

§ 3504.2-4 Form of bond.

Bonds will be furnished on a form approved by the Director.

§ 3504.2-5 Termination of period of liability.

The period of liability of any bond will not be terminated until all terms and conditions in the permit or lease have been fulfilled.

§ 3504.3 Individual sureties.

§ 3504.3-1 Net worth statement.

Each surety must execute a statement showing that he is worth in real property not exempt from execution, double the sum specified in the undertaking, over and above his just debts and liabilities and that he is either a resident of the same State and the U.S. Judicial District as the principal on the bond, or of the State and the Judicial District in which the lands involved are located.

§ 3504.3-2 Certificate required.

There also must be furnished a certificate by a judge or clerk of a court of record, a U.S. Attorney, a U.S. Commissioner, or a U.S. Postmaster, as to the identity, signature, and financial competency of the sureties.

§ 3504.3-3 Requirements.

All bonds furnished with individual sureties will be examined every 2 years, or at any other time when found advisable, and the principal on the bond will be required to furnish new statements of justification by the sureties and a new certificate of financial competency, and if such sureties are unable to qualify additional security will be required.

§ 3504.3-4 Terms.

Where surety bonds are tendered with individuals as sureties they must be executed by not less than two qualified individual sureties to cover compliance with all terms and conditions of the lease or permit or the applicable law or regulations.

§ 3504.3-5 Forms.

The statement of justification required to be furnished by the sureties, and the certificate of competency should be on a form approved by the Director.

§ 3504.4 Corporate bond or personal bond.

§ 3504.4-1 Amount.

To be determined by the authorized officer after consultation with the Mining Supervisor.

(a) Compliance with § 3504.2-1(a)(1) for permits.

(b) Compliance with § 3504.2-1(b) for leases.

(1) *Corporate surety bond.* (i) A corporate surety bond may be filed for a prospecting permit or lease.

(2) *Personal bond*—(i) *Type of bond.* In lieu of a corporate surety bond, a personal prospecting permit or lease bond may be filed.

(ii) *Deposit of securities.* Personal prospecting permit or lease bonds secured by negotiable U.S. bonds of a par value equal to the amount of the required surety bond, together with a power of attorney may be executed on a form approved by the Director.

§ 3504.4-2 Qualified sureties.

(a) *Treasury lists.* A list of companies holding certificates of authority from the Secretary of the Treasury under the Act of Congress, approved July 30, 1947 (6 U.S.C. 6-13) as acceptable sureties on Federal bonds is published in the FEDERAL REGISTER annually.

§ 3504.5 Nationwide bonds.

§ 3504.5-1 Amount.

Lessee may furnish for coal, potassium, sodium, or phosphate a separate bond in the amount of $75,000 for full nationwide coverage of all leases and permits issued for the respective mineral pursuant to the Mineral Leasing Acts, and also pursuant to the Mineral Leasing Act for Acquired Lands (30 U.S.C. sec. 351-359).

§ 3504.6 Statewide bond.

§ 3504.6-1 Amount.

Lessee may furnish for coal, potassium, sodium, or phosphate for each state in which the lessee holds leases or permits separate statewide bond of not less than $25,000 which shall cover all leases and permits issued under this part in that State for the respective mineral.

§ 3504.7 Collective bond.

§ 3504.7-1 Amount.

Lessee may furnish for coal, potassium, sodium, or phosphate a collective bond in an amount not less than the total minimum coverage required if separate bonds on each lease were furnished.

§ 3504.8 Default.

§ 3504.8-1 Payment of surety.

Where upon a default, the surety makes payment to the Government of any indebtedness due under a lease, the face amount of the surety bond and the surety's liability thereunder shall be reduced by the amount of such payment.

§ 3504.8-2 Penalty.

Thereafter upon penalty of cancellation of all of the leases covered by such bond that principal shall post a new nationwide bond in the amount of $75,000, a new statewide bond in the amount of $25,000 or a new collective bond as the case may be, within 6 months after notice, or within such shorter period as the authorized officer of the Bureau of Land Management may fix.

§ 3504.8-3 Relief.

However, in lieu thereof, the principal may within that time file separate bonds for each lease.

§ 3504.8-4 Applicability of provisions to existing bonds.

The provisions hereof may be made applicable to any nationwide, statewide or collective bond in force at the time of the approval of the amendment of this paragraph by filing in the appropriate land office a written consent to that effect and an agreement to be bound by the provisions hereof executed by the principal and the surety. Upon receipt thereof the bond will be deemed to be subject to the provisions of this paragraph.

§ 3504.9 Exploration bond.

§ 3504.9-1 See 43 CFR Part 23.

Subpart 3505—Cooperative Conservation Provisions

§ 3505.1 General.

§ 3505.1-1 Coal fields or prospective areas.

To conserve the natural resources of any coal field or prospective coal area, or any part or zone thereof, and to permit an orderly, efficient and economic development of such coal fields, the act authorizes the Secretary of the Interior to approve cooperative agreements among lessees or permittees and their representatives if such agreements or contracts are certified by the Secretary to be necessary or advisable in the public interest. It also permits him to enter into a development contract with a single lessee and to consolidate the leases or permits of one or more lessees or permittees.

§ 3505.1–2 Solid (hardrock) minerals.

The Secretary of the Interior or his authorized representative may approve operating or development contracts or processing or milling arrangements for the conservation of natural products or whenever in his discretion, the public convenience or necessity may require it or the interests of the United States may be best served thereby.

§ 3505.2 Coal.

§ 3505.2–1 Types of contracts.

(a) *Collective contracts.* The Secretary may approve collective contracts of lessees and permittees and their representatives and others, for prospecting, development or operation of coal fields or prospective coal areas, or any part or zone thereof.

(b) *Development contracts.* The Secretary may enter into a development contract with a single lessee or permittee embracing his leases or permits.

(c) *Consolidation of leases and permits.* The Secretary may consolidate separate Federal permits or leases of one or more lessees or permittees into a lesser number of permits or leases, or into a single permit or lease.

§ 3505.2–2 Application.

(a) *Where filed and copies.* A contract submitted for approval must be filed in the proper land office with enough copies to permit retention of five copies after approval.

(b) *Showing required.* The application must be accompanied by a statement showing all the interests held by the contractor in the area or field and the proposed or agreed plan of operation or development of the field. All the contracts held by the same contractor in the area or field must be submitted for approval at the same time, and full disclosure of the project made. Complete details must be furnished in order that the Secretary may have facts upon which to make a definite determination in accordance with the provisions of the act, and to prescribe the conditions on which approval of the contracts is made.

(c) *Common carrier railroads.* Any company or corporation operating a common-carrier railroad which may be a party to a collective contract or development contract with a Federal lessee under this subpart, to develop its own lands, excluding Federal lands leased by the railroad, in connection with or in cooperation with a Federal lessee or lessees shall not be deemed to be given or hold a lease by virtue of any such arrangement between the working interest owners.

§ 3505.2–3 Special provisions.

(a) *Production and royalties.* A contract approved hereunder shall not provide for an apportionment of production or royalties among the separate tracts comprising the contract area, but may provide for the commingling of production with appropriate allocation to the tracts from which produced. In connection with any contract approved or executed or with any consolidation accomplished under this subpart, the authorized officer may, with the consent of the party or parties involved, establish, alter, change, or revoke mining, producing, rental, minimum royalty, and royalty requirements of such leases or permits or contracts.

(b) *Working interest contracts.* In the case of any contract between lessees or their representatives, or between them and others for collective development or operation of any coal field or coal area, or any part or zone thereof, such arrangement as the working interest owners may enter into for the sharing or division of production among them shall not be deemed to be an apportionment of production or royalties among the separate tracts comprising the contract area.

§ 3505.2–4 Approval.

(a) *Approval of contract.* A contract pursuant to the provisions of this section will be approved or executed by the Secretary.

(b) *Exemption from acreage limitations.* Coal leases and permits operated under a contract pursuant to the provisions of this section may be excepted from acreage limitations or maximum holdings or control imposed by the Act, if it is determined that such exception is required to permit economic development of the resources and is otherwise consistent with the public interest.

§ 3505.3 Solid (Hardrock) minerals.

§ 3505.3–1 Types of contracts.

(a) *Operating or development contract.* The Secretary of the Interior or his authorized representative may approve operating or development contracts, or processing or milling arrangements, made by one or more lessees with one or more persons, associations, or corporations, to justify operations on a large scale for the discovery, development, production or transportation of ores.

§ 3505.3–2 Application.

(a) *Where filed and copies.* An application must be filed in the proper land office in three executed copies, and a duplicate original must be filed with the Regional Mining Supervisor of the Geological Survey. All of the contracts held by the same contractor, in the area, should be submitted at the same time and full disclosure of the project made.

(b) *Showing required.* The contract must be accompanied by a statement showing all of the interests held by the contractor designated in the contract in the area, and also the agreed or the proposed plan of operation or development of the leased lands.

§ 3505.3–3 Approval.

(a) *Approval of contract.* Contracts may, by and with concurrence of the Geological Survey and on such conditions as may be subscribed, be approved by the Secretary or his authorized representative.

(b) *Exemption from acreage limitations.* Operating or development contracts may be approved regardless of acreage limitations provided in § 3501.2–5.

Subpart 3506—Assignments or Transfers and Subleases

§ 3506.1 Qualifications.

§ 3506.1–1 Who may file.

Permits and leases may be transferred in whole or in part to any person, association, or corporation qualified to hold such leases and permits.

(a) *Minors.* A minor is not qualified to hold a permit or lease and a transfer to a minor will not be approved.

(1) *Exception.* An assignment in behalf of a minor heir or devisee of a permittee or lessee to his legal guardian or trustee may be approved.

§ 3506.1–2 Failure to qualify.

No transfer will be approved if the transferee is not qualified to take and hold a permit or lease or if his bond is insufficient.

§ 3506.1–3 Number of copies required.

A single executed copy of qualifications is sufficient.

§ 3506.1–4 Sole party in interest.

Compliance with § 3502.7.

§ 3506.1–5 Attorney-in-fact.

Compliance with § 3502.6.

§ 3506.1–6 Heirs and devisees.

In order for the heirs or devisees of a deceased holder of a permit or lease, an operating agreement, or a royalty interest in a permit or lease, to be recognized by the Secretary as the holder of the permit or lease, agreement or interest, there must be furnished the appropriate showing required under § 3502.8.

§ 3506.2 Requirements.

§ 3506.2–1 Where filed.

An application for approval of an assignment or transfer must be filed in the proper land office as specified in § 3000.5–1.

§ 3506.2–2 Forms and statements.

(a) *Record title; copies required.* Assignments or transfers of record title interest must be filed in triplicate.

(1) *Approved form.* There is no specific form which must be used for assignment transfers or requests for approval thereof. The application must contain evidence of qualifications of the assignee or transferee consisting of the same showing required of a lease or permit applicant as set forth in qualifications subpart 3502.

(2) *Separate instruments required.* A separate instrument of assignment or transfer must be filed for each permit or lease when transfers involve record titles. When transfers to the same person, association, or corporation, involving more than one permit or lease are filed at the same time for approval, one request for approval and one showing as to the qualifications of the assignee or transferee will be sufficient.

(b) *Other than record; title; copies required.* A single executed copy of all other instruments of transfer is sufficient.

§ 3506.2-3 Bonds.

(a) *Coverage.* If a bond is necessary it must be furnished before a transfer of a permit or lease will be approved, the consent of the surety to the substitution of the transferee as principal, or a new bond with the transferee as principal, must be submitted if the original permit or lease required the maintenance of a bond. If the transfer is for part of the land only, it must be for a legal subdivision and (1) the consent of the surety to the transfer and its agreement to remain bound as to the interest retained by the permittee or lessee must be submitted, as well as (2) a new bond with the transferee as principal covering the portion of the lands transferred.

(b) *Continuing responsibility.* The transferor of a permit or lease, including a sublease, and his surety will continue to be responsible for the performance of any obligation under the permit or lease until the effective date of the approval of the transfer. If the transfer is not approved, their obligation to the United States shall continue as though no such transfer had been filed for approval. After the effective date of approval the transferee, including sublessee, and his surety will be responsible for the performance of all permit or lease obligations notwithstanding any terms in the transfer to the contrary. The account under the permit or lease must be in good standing before approval of a transfer will be given.

§ 3506.2-4 Permit or lease account status.

The account under the permit or lease must be in good standing before approval of a transfer will be given.

§ 3506.2-5 Description of lands.

Each instrument of transfer must describe the lands involved in the same manner as described in the permit or lease or in the manner required by § 3501.1-3.

(a) *Effect of assignments.* The approval of transfer of only a part of the lands described in a permit or lease will create a new permit or lease which will be given a current serial number, but a discovery on lands under one permit will not inure to the benefit of the other.

§ 3506.3 Approval.

§ 3506.3-1 Application.

Transfers of permits and leases, whether by direct assignments, working agreements, transfer of royalty interests, subleases or otherwise, must be filed for approval within 30 days from final execution and must contain evidence of the qualifications of the assignee or transferee, consisting of the same showing required of a lease or permit applicant by subpart 3502.

§ 3506.3-2 Effective date.

A transfer will take effect the first day of the month following its final approval by the Bureau of Land Management, or if the transferee requests, the first day of the month of the approval.

§ 3506.4 Royalty interests.

Transfer of royalty interests must be filed within 90 days from final execution and must contain evidence of the qualifications of the assignee or transferee, consisting of the same showing required of a lease or permit applicant by subpart 3502.

§ 3506.5 Extensions.

The approval of such a transfer will not extend the life of the permit or the readjustment periods of the lease.

Subpart 3509—Surface Management

§ 3509 Surface management.

§ 3509.1 See 43 CFR Part 23.

This circular replaces Circulars 1917, 1967, 1968, 2082, 2154, 2155, 2156, 2157, 2219, 2223, 2229, 2230, 2250, 2252, and 2283.

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UNITS #20-24

TITLE: Earth-Moving Machinery

PURPOSE: To acquaint the mining personnel with the various stripping equipment available, their constructional details, operational features, and applications and limitations.

OUTLINE:

- I. General Introduction
  - A. Description of shovels and draglines (Ref. 1, Chapter 13 & Ref. 2)
    - 1. Revolving unit
      - a. Brief description of power transmission system (gears, drums and ropes)
      - b. Boom attachment
      - c. Gantry
      - d. Tram-table, controls
    - 2. Travel unit
      - a. Rubber tired--self-propelled or truck mounted
      - b. Crawler mounting
      - c. Walking mechanism of draglines
    - 3. Digging unit
      - a. Dipper shovel
      - b. Dragline
      - c. Pull or drag shovel
      - d. Clamshell
      - e. Crane
  - B. Brief introduction to other equipment
    - 1. Bucket wheel excavators
    - 2. Tractors, dozers, scrapers, rippers
    - 3. Tower excavators
    - 4. Trucks
    - 5. Drills
    - 6. Pumps
    - 7. Electrical gear
- II. Shovel: Describe in Detail (Ref. 2, 3 & Section 8.1 of Ref. 9)

UNITS #20-24 continued

- A. Types of shovel (examine the differences)
  - 1. Stripping shovel
  - 2. Quarry and mine, or loading shovel
  - 3. Pull or drag shovel (no description)
- B. Constructional details
  - 1. Attachments
    - a. Boom
    - b. Stick
    - c. Crowd mechanism
  - 2. Bucket details
  - 3. Weight and range of shovels
  - 4. Electrical and mechanical gears (may be omitted)
- C. Operational details
  - 1. Digging, hoisting and dumping
  - 2. Walking
  - 3. Safety considerations
  - 4. Application of dipper shovel and pull shovel
  - 5. Relation of the various important dimensions on the positioning of the shovel (Ref. 7)

III. Dragline Description in Detail (Ref. 2, 3 & Section 8.2 of Ref. 9)

- A. Types of dragline
  - 1. Crawler mounted
  - 2. Walking dragline
- B. Construction details
  - 1. Attachments
  - 2. Bucket details
  - 3. Weight and range of draglines
  - 4. Electrical and mechanical gears (may be omitted)
- C. Operational details
  - 1. Digging, hoisting and dumping
  - 2. Walking
  - 3. Application of draglines
  - 4. Safety considerations
  - 5. Relation of various important dimensions on the positioning of the shovel (Ref. 7)
- D. Comparison of dragline and shovel applications (Ref. 5)
- E. Brief reference to tower excavators

UNITS #20-24 continued

IV. Other Equipment

A. Bucket wheel excavators (Ref. 1, Chapter 14, Ref. 6 & 9, Section 8.4)

1. Explain difference in cuffing, transporting and dumping as compared to shovels and draglines
2. Types of wheel excavators

a. German
b. American

3. Operational details

a. Bench-cut
b. Falling cut
c. American frontal block method

4. Application and limitations

B. Tractor (Ref. 1, Chapters 15, 16, 17; Ref. 9, Section 8.3)

1. General description
2. Mode of operation
3. Types of drive
4. Purposes for which used

a. Bulldozer--constructional and operational details (Ref. 1, Chapter 15)
b. Tractor loaders--constructional and operational details (Ref. 1, Chapter 16)
c. Dozer-tractor combination
d. Scrapers

1) Constructional details
2) Operational details
3) Application

5. The forte for the application of these as stripping and loading equipment today (advantages and disadvantages)

C. Rippers, pumps, etc. (mention only)
D. Conveyors, trucks, etc. (mention only)

V. Equipment Selection (Ref. 4, 8, 10; Ref. 1, Chapter 10; Ref. 9, Section 4.2)

A. Type of material

UNITS #20-24 continued

B. Depth of bank
C. Angle of swing
D. Clearances involved
E. Moving requirements
F. Transportation facilities
G. Volume of work
H. Size--big or small philosophy
I. Legal requirements
J. Other available equipment's influence (tandem operation)
K. Capital availability
L. Sociological factors

REFERENCES:

1. Nichols, H. L. Moving the Earth, North Castle Books, Greenwich, Connecticut (1962).

   Excellent reference manual. However, details are scattered throughout the book and lecture notes on any desired detail can be prepared on all the topics listed above by reference to the index. (Important chapters are 10, 13, 14, 15, 16 and 17.)

2. Anonymous. The Functional Design, Job Applications and Job Analysis of Power Crane and Shovels, Technical Bulletin No. 1, Power Crane and Shovel Association (1961).

   This is a complete and exact reproduction of the Power Crane and Shovel Association slide film entitled "The Changing World," containing about 100 slides. This will be very useful teaching aid.

3. Anonymous. Power Cranes, Shovels, Draglines--Attachments, Traction, Operation, Technical Bulletin No. 4, Power Crane and Shovel Association (1963).

   Excellent reference manual for operational details of draglines and shovels.

4. Anonymous. Proper Sizing of Excavators and Hauling Equipment, Technical Bulletin No. 3, Power Crane and Shovel Association (1966).

5. Thompson, D. M. Strip Coal Mining Design Systems, Unpublished M.S. Thesis, Department of Mineral Engineering, The Pennsylvania State University, University Park, Pennsylvania (1953).

   Good comparison of dragline and shovel for stripping (pp. 6-17).

UNITS #20-24 continued

6. Venkataramani, R. Computer Simulation of Bucket Wheel Excavators, Unpublished M.S. Thesis, Department of Mineral Engineering, The Pennsylvania State University (1968).

Description of American and German wheels and their modes of operation and limitation.

7. Ferko, M. R. Analysis of Stripping Equipment and Methods, To be published, Department of Mineral Engineering, The Pennsylvania State University (1972).

A comprehensive report on equipment and stripping methods.

8. Anonymous. "Mining Guidebook," Coal Age, McGraw-Hill, New York, July issue each year.

Brief summary of all aspects of surface mining.

9. Pfleider, E. P. Surface Mining, AIME, New York (1968).

Good general reference book.

10. Fuller, J. A., et al. "Selection of Stripping Equipment," Mining Congress Journal (October 1965).

UNIT #25

TITLE: Drilling for Overburden Preparation

PURPOSE: To acquaint personnel with proper fragmentation of overburden, essential to keep stripping costs down and safety high. Different types of drills and techniques are available for particular applications and thus, this lecture should reveal optimum drill selection and use.

OUTLINE:

I. General Discussion of Overburden Drilling

   A. Purposes and reasons for drilling
   B. Effect on stripping machine selection

II. Drilling Techniques

   A. Horizontal drilling

      1. Brief description
      2. Advantages
      3. Disadvantages
      4. Trend

   B. Vertical drilling

      1. Brief description
      2. Advantages
      3. Disadvantages
      4. Application trends

         a. Deck loading
         b. Higher strip ratios

III. Types of Drills--Principles and Applications

   A. Percussion including downhole
   B. Auger
   C. Roller bit

IV. Safe Procedures in Drilling

REFERENCES:

1. Pfleider, E. P. Surface Mining, AIME, New York, Section 6 (1969).

2. Anonymous. "Mining Guidebook," Coal Age, McGraw-Hill, New York, July issue each year.

UNIT #26

TITLE: Explosive Selection and Handling in Overburden Preparation

PURPOSE: To acquaint personnel with the wide variety of explosives available and factors entering into selection and use based upon technological and economic feasibility as well as safety.

OUTLINE:

I. Properties of Explosives and Correlation With Use

  A. Strength
  B. Density
  C. Sensitiveness
  D. Velocity
  E. Water resistance
  F. Freezing resistance
  G. Inflammability
  H. Fumes

II. Types of Explosives and Area of Utilization

  A. Dynamite and other high explosives
  B. Blasting agents--dry ANFO
  C. Slurries

III. Hole Preparation

  A. Priming
  B. Loading
  C. Firing techniques

    1. Electrical
    2. Primacord
    3. Safety fuse

  D. Detonation devices

IV. Safe Use of Explosives

  A. General precautions
  B. Handling and storage
  C. Do's and don'ts
  D. Hazards of extraneous electricity

REFERENCES:

1. E.I. duPont deNemours & Company. Blasters' Handbook, Fifteenth Edition (1966).

2. Pfleider, E. P. Surface Mining, AIME, New York, Section 7 (1968).

UNIT #27

TITLE: Blasting Techniques

PURPOSE: To show how natural conditions and the geometry of the highwall affect the determination of patterns and rounds.

OUTLINE:

I. Powder Factors

   A. Burden selection
   B. Spacing selection

II. Typical Blasting Rounds

   A. Effect of rock properties
   B. Effect of highwall geometries
   C. Equipment consideration

III. Delay Firing

   A. Economics
   B. Ground vibrations and air blast

IV. Wiring Arrangements

   A. Primacord
   B. Electrical blasting caps

      1. Series
      2. Parallel
      3. Series-parallel
      4. Galvanometer check

V. Review Federal and State Laws Pertaining to Blasting

REFERENCES:

1. Pfleider, E. P. Surface Mining, AIME, New York, Section 6 (1969).

2. Anonymous. "Mining Guidebook," Coal Age, McGraw-Hill, New York, July issue each year.

3. E.I. duPont deNemours & Company. Blasters' Handbook, Fifteenth Edition (1966).

UNITS #28-32

TITLE: Stripping Techniques

PURPOSE: To acquaint the mining personnel with the various stripping techniques currently in practice, equipment combinations, and application and limitations.

OUTLINE:

I. Introduction

  A. Brief description of general stripping techniques

    1. Contour stripping
    2. Area stripping
    3. Quarrying
    4. Augering

  B. Selection of stripping method and equipment

    1. Geological conditions
    2. Equipment--big or small
    3. Reclamation

  C. Pit planning and engineering design

    1. Factors affecting pit limits
    2. Width of pit
    3. Meet legal and social constraints
    4. Safety considerations

  D. Topsoil removal and acid spoil segregation

II. Case Studies in Stripping

  A. Stripping with shovels and draglines

    1. Contour stripping in highly hilly areas
    2. Contour stripping in rolling hills
    3. Area stripping

  B. Stripping with wheel excavator
  C. Bulldozer stripping
  D. Tandem stripping

    1. Shovel and draglines
    2. Draglines and wheel excavator
    3. Bulldozer--shovel or dragline
    4. Scrapers--shovel or dragline

  E. Multiple-seam mining
  F. Open-pit mining of thick coal seams

UNITS #28-32 continued

Note to instructor: Each case study must be illustrated with the following items in mind.

1. Reasons for choice of the method
2. Equipment list
3. Equipment moves
4. Performance figures
5. Problems encountered in changing conditions
6. Any suggestions for improvement
7. Line diagrams of actual stripping method

REFERENCES:

1. Anonymous. "Mining Guidebook," Coal Age, McGraw-Hill, New York, July issue each year.

    Specific case studies can be expanded to the desired length by reference to original article which is referenced in the guidebook.

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    Contains ten specific case studies covering most of the equipment combinations.

3. Porter, W. E. Multiple Seam Strip Mining: A Survey and Economic Feasibility Model, Mineral Engineering Management Report, Department of Mineral Engineering, The Pennsylvania State University (1972).

    Contains specific case studies of multiple seam stripping with shovels and draglines.

4. Anonymous. "New Ideas for Open-pit Mining," Engineering and Mining Journal (December 1964).

5. Rumfelt, H. "Recent Developments in Surface Mining," Mining Congress Journal (September 1965).

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8. Pfleider, E. P. Surface Mining, AIME, New York, Sections 4.1, 4.2, 5.1, 5.2, 13.1 (1968).

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UNITS #33-34

TITLE: Coal Loading and Haulage

PURPOSE: To present the basic methods of loading and transportation of coal in strip mining operations.

OUTLINE:

I. Loading

   A. Preliminary and surface cleaning (Ref. 1, 4 & 5)

      1. Rock and shale layers have sometimes been deposited with the coal seam. If these partings are not excessive, and the coal preparation plant has sufficient capacity, the impurities are loaded with the coal.

      2. Special equipment may be needed to clean the final layer of shale or clay from the top of the coal seam after stripping is completed.

         a. Cleaning can be done with

            1) Tractor-scrapers
            2) Bulldozers
            3) Graders
            4) Rubber-mounted scoop loaders
            5) Power sweepers

         b. If there are any clay veins in the coal or if the top is very irregular, it may be necessary to remove part of the dirt by hand. However, hand cleaning is expensive and should be avoided.

   B. Coal breaking and ripping operations (Ref. 1 & 4)

      1. Coal blasting

         a. In some cases, coal is of such softness that blasting is not required for loading.

         b. Where the coal is of average thickness and hardness, explosives used in breaking the overburden usually will loosen the coal sufficiently.

         c. At times, it is necessary to drill and shoot the coal in a separate operation. Holes are drilled on a regular pattern and loaded with a light charge of explosives.

2. Ripping method

   a. Coal can be dislodged with ripper teeth mounted on the rear of a track-type tractor.

   b. This method works well in coal less than four to six feet thick.

   c. Resulting broken coal is low in fines and large lumps.

C. Loading methods (Ref. 1, 4 & 5)

1. The first consideration in choosing a coal-loading machine is to match its capacity to the ability of the overburden-removal unit to uncover coal. Usually, loaders are selected with a slightly greater loading ability than needed for normal operation (loader can catch up in case of haulage or contributing delays).

2. Loading equipment

   a. Thin seams: Dipper moves parallel to bottom when loading. Units can scoop up a wide channel of coal without disturbing bottoms.

      1) Horizontal thrust shovels
      2) Skimmer
      3) Front-end loader

   b. Excessive rock and shale partings

      1) Remove coal above parting.
      2) Side-cast the parting or load into end-dump trucks (dispose in the open coal pit).

   c. Thick seams

      1) High-lift front-end loaders
      2) Shovels
      3) Bench loading

3. Costs and economics

   a. Coal loader should be able to load maximum tonnage.

   b. This means that the loader must be continuously loading coal.

UNITS #33-34 continued

II. Haulage (Coal haulage units of sufficient number and capacity should be provided for the loading units and to meet scheduled requirements. For example, a 12-yard shovel loads a 70-ton truck with about eight swings in about three and one-half minutes. A shovel with an eight-yard dipper will load a 45-ton truck in the same time and number of swings.)

  A. Truck haulage (Ref. 1, 3 & 4)

    1. Surface haulage roads

      a. Main haul roads should have ample width for passing, good sight distance, and long-radius superelevated curves.

      b. They should be well drained and designed with the least possible adverse grades

      c. Subgrades should be of material sufficient to support the heaviest of equipment.

      d. The surface should be of material that can be easily worked with a road patrol grader to eliminate the formation of ruts.

      e. Sprinkling with water is important for driver safety, maintaining high speed, and reducing engine and truck maintenance.

    2. Road planning

      a. Roads should be planned well in advance and, when fills are needed to get the proper grade, they should be built up well ahead of the time they are needed.

      b. Grades should be avoided as much as possible to keep power requirements down. For example, it takes twice as much force to move a 20-ton load up a five percent grade than on level.

      c. When conditions permit, the regular spacing of pit entrances from main roads will provide circle pit hauls with one-way traffic. These entrances should be engineered to the grade-ability of the trucks.

      d. Trucks with more transmission speeds or with torque convertors offer a wider range to negotiate grade and road conditions.

3. Selecting trucks

    a. Choosing the largest available unit does not always result in a lower haulage cost per ton.

    b. Truck selection is based on many factors

        1) Production
        2) Pit width
        3) Types of roads
        4) Grades
        5) Distances
        6) Size of loaders, etc.

    c. Some of the items to be considered when matching trucks with loading units

        1) Capacity of truck should be matched with the capacity of the loader.

        2) Overall height of the truck should be that it makes a good target for loader.

        3) Length should be minimum and width should be maximum.

        4) Truck should be able to turn around in cramped quarters in as short a time as possible.

4. Selecting tires

    a. Prime requirements of off-highway tires

        1) Strength
        2) Wear
        3) Toughness
        4) Traction
        5) Heat resistance
        6) Flotation (occasionally)

    b. Selection of the right tire involves determining the size and ply rating needed to carry the load, and then choosing the design best suited to the conditions of the job.

    c. After these have been selected, considerations must be given to tread depth.

UNITS #33-34 continued

5. Tire maintenance: An effective program of tire maintenance should include the following.

    a. Systematic tire inflation
    b. Use of valve caps on all valve stems
    c. Systematic inspection to detect trouble or the need for retreading
    d. Analysis of worn or damaged tires
    e. Good tire records
    f. Training of maintenance men and drivers in tire care

6. Rules and regulations pertaining to haulage (Specifically, highlight Subpart Q of Part 77 of the Federal Register)

    a. Traffic rules, signals and warning signs
    b. Authorized person restrictions
    c. Safety

B. Belt and rail haulage (Ref. 2)

1. These methods of haulage are usually not applicable to small strip mine operations.

2. In general, long hauls (more than a mile), large tonnages, and flat slopes favor rail haulage.

3. Shorter hauls, lower tonnages, and steeper grades favor trucks or belts.

REFERENCES:

1. Anonymous. "Surface Mining," Coal Age, McGraw-Hill, New York, pp. 170-87 (July 1970).

2. Current Coal Age Mining Guidebooks.

3. Anonymous. "Open-pit Mining Guidebook," Engineering and Mining Journal, pp. G58-G76 (May 1954).

4. Nichols, H. L. Moving the Earth, North Castle Books, Greenwich, Connecticut (1962).

5. Weimer, W. H. "Production Engineering in Surface Coal Mines," Surface Mining, E. P. Pfleidler, Editor, AIME, New York, pp. 224-46 (1968).

6. Woodruff, S. D. Methods of Working Coal and Metal Mines, Volume 3, Pergamon Press, London, pp. 434-8 (1966).

UNIT #35

TITLE: Auger Mining

PURPOSE: To provide an introduction to the techniques of auger mining.

OUTLINE:

I. Auger Operations Are Basically of Two Types (Ref. 5)

  A. Augering of highwall prepared, or left, by stripping operations

    1. Requires little pit clean-up and will have serviceable haulage roads.

    2. An existing pit is usually wide enough to accept any of the existing auger machinery.

  B. Augering of outcrop coal

    1. Requires the preparation of a working bench and roads.

    2. Usually, this operation has higher costs than the first.

II. Preparation of the Augering Site

  A. The following items should be considered in the planning stages (Ref. 5)

    1. Coal seam should lay relatively flat or pitch at a constant angle and be free from rolls and faults.

    2. Coal seam may have impurities but wide or excessively hard horizontal bands of sandstone or other abrasive material will cause excessive wear and breakage of bits, pilots and heads.

    3. Quality of the coal seam should be predetermined by core drilling if necessary.

    4. Sales volume and potential market should be determined to establish a basis for the expenditure of money for equipment and mine development.

  B. Correlation should be made with stripping operations if both methods are utilized.

C. Highwall should be left in the best possible condition (slides can damage equipment and endanger workers).

D. Pit widths should be adequate to accommodate equipment.

E. The facing up operation or bench preparation should be done in such a manner that the augering machine will have a solid footing and the bench area should have controlled drainage.

F. Augering operations should proceed as soon as possible.

   1. With new highwall (to prevent weathering and sloughing)

   2. With old highwall (it might require cleaning with bulldozer and/or shovel).

III. Augering Equipment--Manufacturers, Design and Construction (Ref. 3 & 5)

A. Available diameter range from 16 to 84 inches. Larger ones are capable of producing 25 tons per minute.

B. Augering equipment has been available from three manufacturers in the United States

   1. Salem Tool Company, Salem, Ohio
   2. Long-Airdox Company
   3. Augering equipment (the "push-button" miner) was available from Joy Manufacturing Company, but has been discontinued.

IV. Augering Methods (Ref. 2, 3 & 5)

A. Crew requirements (production crews usually consist of two to three men)

B. Hole depths (present equipment capable of drilling holes 150 to 200 feet in depth; hole spacings)

C. Auxiliary equipment

   1. Elevating conveyors--for loading
   2. Haulage trucks--normally 15 to 35 tons
   3. Bulldozers--for preparing augering site
   4. Shovels--for preparing augering site

UNIT #35 continued

V. Rules and Regulations Pertaining to Auger Mining (Specifically, Subpart P of the Federal Register)

   A. Safety requirements
   B. Water pollution control
   C. Sealing of holes

VI. Case Studies and Examples (Several case studies are presented in Ref. 2, 3 & 5. It is suggested that the following specific items be covered.)

   A. Number of workers required
   B. Mining and auxiliary equipment utilized
   C. Bench widths and haulage road required
   D. Hole number, spacing and depths
   E. Productivity

REFERENCES:

1. Anonymous. "Surface Mining," Coal Age Mining Guidebook, McGraw-Hill, New York, pp. 185-6 (July 1970).

2. Jones, D. C. "They're Augering Around the Mountain," Coal Mining & Processing, pp. 20-5 (July 1965).

3. Woodruff, S. D. Methods of Working Coal and Metal Mines, Volume 3, Pergamon Press, London, pp. 440-6 (1966).

4. Current Coal Age Mining Guidebooks.

5. Zager, L. F. "Auger Mining Standards and Comparative Costs," Mining Congress Journal, pp. 20-2 & 26 (January 1962).

UNITS #36-37

TITLE: Power Systems and Auxiliary Equipment

PURPOSE: To present the basic components of strip mine electrical power systems, to highlight the rules and regulations pertaining to the utilization of electrical equipment, and to cover some important auxiliary equipment in strip mining.

OUTLINE:

I. Power Systems

A. Introduction: The "Mandatory Safety Standards for Surface Coal Mines," Part 77 of the Federal Register will be stressed throughout the following information. Several words are used when mine power distribution systems and equipment are discussed. Consequently, a brief description of these terms will be helpful in understanding this section of these instructional units (Ref. 1).

1. Volts refer to the pressure or force that causes electricity to flow, while amperes (current) refer to the rate at which the electricity flows. There can be no current unless a voltage exists, but there may be voltage without any flow of current.

2. Electrical resistance is that property of a material which opposes the flow of current.

3. Work is defined as the overcoming of opposition through a certain distance. Work which is done electrically is measured in "volt-amperes" or watts. It is current that does the work, but voltage is necessary to produce and maintain the current. Kilowatts means 1,000 watts.

4. Power is simply the rate of doing work; the unit of measurement is normally horsepower. Horsepower and watts are directly connected by a constant (1 hp = 746 watts).

5. Energy is defined as the ability to do work. When we purchase electrical power, we are really purchasing energy. Measurements are watt-hours or kilowatt-hours (kwh).

6. Transmission lines and trailing cables are devices for carrying electrical current. Both are also called conductors. Trailing cables are the conductors directly connected to (mobile) mining equipment. Transmission lines and/or cables are used for primary power distribution.

7. Transformers are magnetic devices used to change the voltage-current relationships of electrical power. They are primarily used to increase or decrease voltage.

8. Protective devices

   a. Circuit breakers are devices that "break" the flow of electrical power usually when current exceeds a predetermined level. A fuse provides the same protection; however, after iterruption, a circuit breaker can be reused.

   b. Lightning arrestors provide protection to electrical distribution systems and equipment if lightning happens to strike an electrical conductor in the system.

9. Grounding refers to the technique of maintaining part of the electrical system at earth voltage (potential or ground).

B. Highlight the Federal Rules and Regulations pertaining to surface coal mines (Specifically, Subparts F, G, H, I and J of Part 77 of the Federal Register).

C. Utilization of electrical power (Ref. 3): Because of increasing power consumption and costs, those companies utilizing electrical power plan and install the electrical segments of their mining system to achieve the maximum of safety, reliability, voltage quality, ease of maintenance, and flexibility plus minimum cost.

II. Auxiliary Equipment

A. Communications (Ref. 4)

1. Wired systems--telephones
2. Nonwired systems--radio
   a. Citizens' band radio systems
   b. Industrial band radio systems

UNITS #36-37 continued

B. Pumping (Ref. 5)

1. Sources and estimation of water quantity
2. Location of pumps
3. Selection and type of pumps
    a. Horizontal centrifugal
    b. Vertical turbine
    c. Submersible motor-vertical turbine

REFERENCES:

1. Jones D. C. and Myles E. Altimus, Jr. Mechanical Mining Electrical Applications, Continuing Education Stores, The Pennsylvania State University, 445 pp. (1971 printing).

2. Anonymous. "Efficient Power Designs," Coal Age, McGraw-Hill, New York, pp. 216-23 (July 1970).

3. Current Coal Age Mining Guidebooks.

4. Buys, V. W. and R. E. Havener. "Communications," Surface Mining, AIME, New York, pp. 744-9 (1968).

5. Stubbins, J. "Dewatering and Flood Control," Surface Mining, pp. 750-61 (1968).

6. Anonymous. Cameron Pump Operators' Data, Ingersoll-Rand Rand Company, New York, 187 pp. (1943).

SUGGESTED HANDOUTS:

Subparts F, G, H, I and J of Part 77 of the Federal Register.

UNIT #38

TITLE: Maintenance of Equipment

PURPOSE: To provide the industry with a broad picture of the value of maintenance planning, procedures and facilities to both management and labor.

OUTLINE:

I. Preventive and Breakdown Maintenance (Ref. 1 & 2a)

  A. Maintenance compared to overall mining cost

    1. Shovels
    2. Trucks
    3. Drills
    4. Bulldozers
    5. Auxiliary equipment

  B. Selection and training of personnel
  C. Preventive maintenance

    1. Selection of equipment
    2. Record keeping
    3. Care of equipment

  D. Breakdown maintenance

    1. Major
    2. Minor
    3. Tools and equipment

  E. Critical path method of planning projects

II. Equipment Scheduling--Including Utilization and Availability (Ref. 1 & 2b)

  A. Scheduling
  B. Utilization
  C. Availability

    1. Mechanical
    2. Physical

III. Equipment Maintenance versus Replacement (Ref. 2c)

  A. Stripping equipment
  B. Loading equipment
  c. Haulage trucks

UNIT #38 continued

- D. Auxiliary equipment

  - 1. Bulldozers
  - 2. Drills

- E. Preparation plant
- F. Supervisory transportation

IV. Road and Property Maintenance (Ref. 1 & 2d)

- A. Design and construction
- B. Road maintenance
- C. Property maintenance

V. Maintenance Facilities (Ref. 1, 2e & 3)

- A. Determination of shop facilities

  - 1. Haulage facilities
  - 2. Maintenance organization
  - 3. Climatic conditions
  - 4. Degree of self-maintenance

- B. General shop design and construction
- C. General maintenance and repair shops

  - 1. Machine shop
  - 2. Metal working lathe, etc.
  - 3. Tool room
  - 4. Welding machines
  - 5. Electric shop
  - 6. Drill repair shop
  - 7. Shovel repair shop

- D. General maintenance
- E. Surface maintenance (labor pool)
- F. Area maintenance shops (field shovel repair/electric shovel repair shop)
- G. Automotive repair facilities

  - 1. Repair stalls
  - 2. Service pit design
  - 3. Lubrication equipment
  - 4. Engine, transmission and component overhaul
  - 5. Fuel injection parts repair
  - 6. Automotive electric, automotive welding
  - 7. Cleaning and painting
  - 8. Automotive tools, equipment
  - 9. Spare parts

UNIT #38 continued

H. Tire changing and repair facilities

1. Convenience facilities
2. Tire storage
3. Handling facilities
4. Tire hardware
5. Buildup and breakdown
6. Tire repair facilities
7. Hydroflation facilities

I. Transportation and service equipment
J. Stores and warehousing

REFERENCES:

1. Anonymous. "Mining Guidebook," Coal Age, McGraw-Hill, New York, pp. 200-8 (July 1972).

2. Pfleider, E. P. Surface Mining, AIME, New York (1968)
    (a) pp. 651-8
    (b) pp. 659-70
    (c) pp. 671-7
    (d) pp. 678-82
    (e) pp. 683-722.

3. Anonymous. "Open-pit Mining Guidebook," Engineering and Mining Journal, McGraw-Hill, New York, pp. 82-94 (May 1954).

UNIT #39

TITLE: Diesel Equipment Maintenance

PURPOSE: To present the important aspects of planned preventive maintenance of diesel powered strip mining equipment with emphasis on engines.

OUTLINE:

I. Introduction: How the Diesel Engine Works (Ref. 1)

   A. The majority of excavating and hauling machines use diesel engines. Diesel (as well as gasoline engines) are called internal combustion machines because fuel is burned inside the same instrument that turns a shaft.

   B. Diesels must have a supply of clean air and clean fuel. A film of oil must be maintained on all moving parts. The engines must be kept at an even temperature by a cooling system. Industrial engines usually have a throttle to regulate speed; some have governors that automatically open and close the throttle to maintain a particular speed.

   C. Diesels may utilize two or four strokes of each piston to complete a full cycle of operation. On both designs, air is drawn in on an intake stroke and compressed so tightly that it becomes very hot. Near the top of the compression stroke, fuel oil is sprayed into the engine's cylinder and ignited by the hot air.

      1. The operation requires no ignition or carburetor systems.

      2. The engine does need proper timing so fuel is ignited at the right time and a method of metering for the correct amount of fuel. The fuel must mix completely with the air so the combustion can be efficient.

      3. Higher compressions and temperatures exist in diesel engines when compared with gasoline designs. Consequently, diesels must be more strongly and finely built.

   D. Four-stroke engines

      1. Piston and valve action is identical to the common four-stroke gasoline engine (power principle is quite different).

UNIT #39 continued

2. As illustrated in Figure 12-81, air is drawn into the machine and exhaust gases forced out during different segments of the full cycle.

3. Compression ratios range from a minimum of 16:1 to a high of approximately 20:1.

4. Engine speed is controlled by the amount of fuel injected during the compression stroke.

E. Two-stroke engines

1. A blower is used to force air into the engine's cylinders and exhaust gases out simultaneously.

2. Figure 12-82 shows the full cycle of operation. Most two-cycle designs use poppet exhaust valves; however, some have no moving valves and use "loop scavenging" to remove exhaust gases.

3. Compression ratios are roughly the same as four-stroke engines.

II. Planning Preventive Maintenance Cycles: Certain points pertaining to why proper maintenance of internal combustion equipment is important have already been indicated during the instructional unit on noise. The best guide to initiate a planned maintenance cycle is the manufacturer's operation (or owner's) manual. In most cases, the manual should provide all information necessary; however, adjustments may be required to fit the individual operator's needs. As maintenance will vary greatly from machine to machine (and manufacturer), the goal of this instructional unit is to illustrate why certain aspects of maintenance are important, rather than how to perform the task (Ref. 1).

A. Lubrication: Proper lubrication is a fundamental necessity for machine operation. The lubrication provides a slippery film between surfaces rubbing, turning or scraping on each other. This film reduces friction and the wasted power, wear and heating that friction causes. Lubricants may also serve as a cooling medium and as a barrier or cleaner to keep abrasive material from getting or remaining between moving parts.

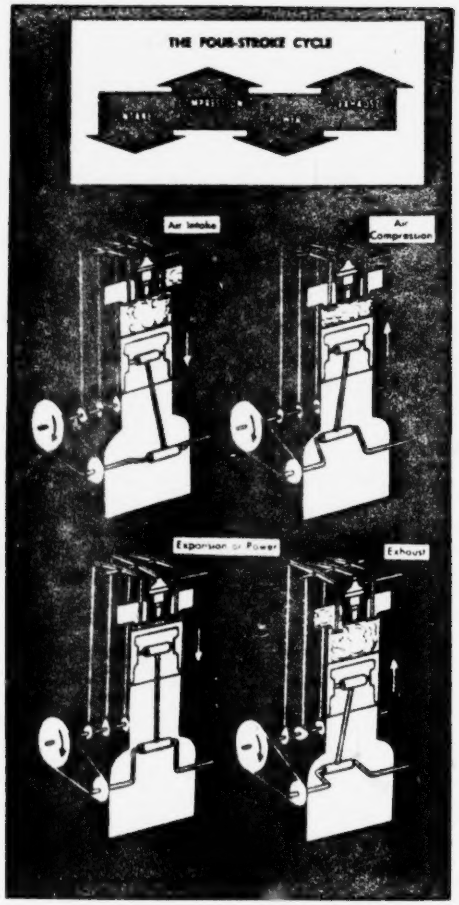
THE FOUR-STROKE CYCLE
Air Intake
Air Compression
Expansion or Power
Exhaust

FIGURE 12-81

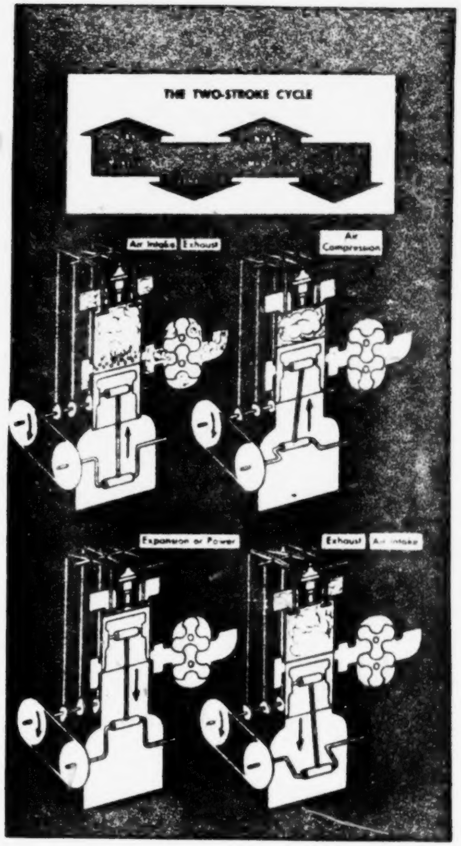
THE TWO-STROKE CYCLE
Air Intake
Exhaust
Air Compression
Expansion or Power
Exhaust
Air Intake

FIGURE 12-82

Courtesy of Detroit Diesel Engine Division, General Motors Corporation

SOURCE: Reference 1

1. Dirty oil

    a. It is nearly impossible to keep foreign materials out of oil. The serious contamination is usually from outside sources.

        1) Dirt in oil cans or funnels
        2) Oil dip stick
        3) Inadequately protected or improperly serviced air filter
        4) Improperly protected crankcase breather or PVC valve

    b. Although oil filtration systems are quite efficient, they cannot always remove all of the above contaminants. If highly abrasive, like sharp silica particles, a fraction of a teaspoonful may cut a big engine to pieces before it is filtered out.

2. Diesel lube oil

    a. Diesel engines tend to produce sludge and varnish-depositing compounds as by-products of combustion.

        1) Special heavy-duty oils have been developed that contain detergents to keep these substances in suspension, rather than making harmful deposits.

        2) It is absolutely necessary that these be used instead of non-detergent oil.

    b. Some of the heavy-duty motor oils sold at premium prices are suitable for use in diesels, but the engine manufacturer should be consulted before trying any brand.

B. Air filters: As was mentioned in the introduction, clean air must be supplied to the engine. The air filter has the job of filtering the dust out of the air to prevent it from wearing moving parts.

1. Oil bath filters

    a. Usually found on equipment manufactured before 1960.

UNIT #39 continued

    b. Its oil reservoir should be cleaned and refilled and the wire mesh cleaned and reoiled frequently.

    c. The case must be put back carefully, making sure that the gasket between the cap and case is seated properly.

  2. Dry-type filters: Filter may be serviced by using a jet of clean dry air or replacing element.

  3. Either type of filter can cause severe restricted air flow to the engine. The result can be excessive engine exhaust smoke, and/or loss of power.

C. Indications for services: Time and mileage are the best indicators. However, several checks can be made on a regular basis to insure proper engine performance. These include

  1. Compression testing
  2. Fuel pump pressure checks
  3. Fuel consumption monitoring
  4. Exhaust gas conditions
  5. Tuning

D. Smoke

  1. The diesel is normally a clean burning engine, as the cylinders are normally charged with more than enough air to burn the maximum amount of injected fuel.

  2. It does exhaust some bad smelling, irritating, and moderately toxic gases. However, the exhaust is almost free of carbon monoxide, and the noxious gases can be removed by an efficient exhaust conditioner

    a. Exhaust scrubbers
    b. Catalytic convertors

  3. Excavating machines and off-the-road haulers almost never show black exhaust smoke. On the other hand, all too many highway trucks put on a good imitation of a smoke screen.

UNIT #39 continued

4. Smoking is an indication of
    a. Fuel being wasted
    b. Oil being contaminated with sludge
    c. Exhaust valves and mufflers being damaged with still burning gases

5. Consequently, any alert foreman or operator will send the maintenance personnel if he sees a dirty exhaust.

REFERENCES:

1. Nichols, H. L. Moving the Earth, North Castle Books, Greenwich, Connecticut, Chapter 12, pp. 77-102 (1962).

2. Anonymous. "Maintenance Engineering," Coal Age Mining Guidebook, pp. 207-15 (July 1970).

UNIT #40

TITLE: Reclamation--Planning and Potential Land Use

PURPOSE: To set the stage for the need for reclamation. Also presented are concepts useful in the planning stage of reclamation, as well as some ideas to maximize the potential for profit after the land is reclaimed.

This lecture should be delivered by someone familiar with local land uses. An official from the Bureau of Mines, State or Federal, a local county soil conservation agent, a member of the local or regional planning commission, or a local landscape architect are possible choices for lecturer. An obvious first choice is someone who has dealt with local reclamation problems.

OUTLINE:

I. The Need for and Importance of Reclamation

A. Reclamation is considered such an important part of strip mining that it is incorporated in most strip mining laws (Ref. 2). It is wise to recapitulate those factors that have led to the enforcement of reclamation.

1. Damage: Unreclaimed land can contribute acid and sediment to streams. On steep slopes, it is subject to slides. These unwanted activities can damage a third party's land, property, or water rights. Thus, unreclaimed land can conflict with the legal maxims of equity.

2. Aesthetics: Unreclaimed land is considered unsightly by many citizens. Lack of reclamation is considered a rebuff by these citizens and leads to bad relations between coal producers and citizens' groups.

3. Economics: Unreclaimed land is often unproductive. Benefit is lost by the individual owner who is unable to sell the land or to produce from it. Benefit is also lost by the public at large who are unable to use the land as a forest resource, game preserve, etc.

B. Because of the importance of these factors, the legal entities in the coal-producing regions, whether local, state, or federal, have decided that reclamation is a necessity. Since an operator must reclaim, it is well to determine how the operator can receive maximum

UNIT #40 continued

benefit from this activity. In an approximate sense, the benefits of reclamation--in addition to remaining in legal compliance--are exactly opposite to

1. Elimination of damage to neighboring properties
2. Assumption of the role of a "good neighbor" by leaving property in an acceptable aesthetic condition
3. Maximization of income from the land after mining ceases.

II. Considerations of Present Value (If reclamation is to be more than a blind reorganization of the land surface, concern must be shown for the land's ultimate use. A first step is a determination of its present use and value. Of necessity, this determination must include more than a visual inspection of the land.)

A. Present use (What is the specific present, pre-mining use of the surface? The following categories include many of the major uses of land surface; some of the categories include areas where surface mining would be difficult. These are marked with an asterisk (*). With the help of a knowledgable person (land assessor), the present use of the surface (before stripping) should be identified.

1. Forest or other untended land

    a. Timber extracted
    b. Game preserve (no hunting)
    c. Recreation

        1) Hiking, camping, canoeing, etc.
        2) Recreational vehicles (snowmobiles, dune buggies, etc.)
        3) Skiing
        4) Hunting and fishing

2. Agriculture

    a. Pasture
    b. Major crops

3. Domicile

    a. Suburban, sparse
    b. Suburban, dense*

4. Industrial

   a. Sparse
   b. Dense*
   c. Other

B. Present value (This assessor should then help determine the current and the potential value of the surface.)

1. The current value is the price the land would fetch if sold as is. This value should take into account current tax rates on the land, but should exclude the mineral values.

2. The potential value of the land takes into account the value of surrounding land. A good example is Florida swamp land worth a few hundred dollars per acre; after draining and redevelopment it can become worth tens of thousands of dollars per acre. Inasmuch as reclamation will give an opportunity to reshape the surface, consideration must be given to the maximum potential value of the land. Again, a good local land assessor can be of great help in determining local land values.

III. Considerations of Post-Stripping Land Use (Within the legal framework, there are many choices involved in reclamation: backfill to contour or terrace; replant with trees, shrubs, grasses, or a mixture of the three; and prepare for abandonment or for some specific use such as agriculture. Inasmuch as most states require reclamation plans to be formulated before mining begins, it is a good idea to have some plan for the post-stripping use of the land. This plan can then help set the objectives of and guidelines for a reclamation program. Once these concepts are considered, it will be seen that a good deal of common sense and a bit of forethought will contribute greatly to public relations and, even, to profits.)

A. Land use choices and appropriate reclamation (This subsection will examine some of the land uses listed under II-A, and will suggest reclamation schemes appropriate to these uses. The next subsection will give some guidelines on how to choose a post-stripping use. Subsequent units will give details on the reclamation schemes.)

UNIT #40 continued

1. Forests: Maximize available land, reduce or eliminate high walls, backfill to contour
    a. Timber
        1) Plant the desired species.
        2) Space according to planting. instructions.
        3) Leave room for mechanized equipment.
    b. Game preserve
        1) Plant alternating strips of grasses and shrubs.
        2) Plant some trees.
    c. Recreation (seek advice of proper expert)
        1) Landscape architect for golf course
        2) Ski people for ski slopes, etc.
2. Agriculture
    a. Maximize tillable land.
    b. Promote water retention but minimize erosion.
    c. Terrace backfill.
3. Housing
    a. Reclamation should be planned with a developer.
    b. Essential items are land stability and roads.
    c. Desired item is land variety--homes should have views, should be at different elevations, etc. (terrace backfill is probably preferable).
4. Industrial
    a. Flat space is a premium item for industrial planning.
    b. Roads are also essential.
    c. Industrial parks and airports are two kinds of industrial projects already attempted on reclaimed land (terrace backfill).

UNIT #40 continued

B. Choosing a post-stripping land use (The common reaction of most surface miners to the need for reclamation is to comply with legal demands and then to abandon the land. Occasionally, it is heard that some company has an inspired plan for post-stripping use of their land. It is the intention of this unit to promote these inspirations.)

  1. Two major related factors should be considered in choosing a land use.

     a. Present use and potential value (as discussed before) of the land under consideration and of neighboring tracts

     b. Trends in land use experienced in the region

  2. The obvious first choice for a post-stripping use is that which has the highest potential value.

     a. If home building is on the increase in an area, the land should be prepared for homesites.

     b. If forest land is being prepared for agriculture, then the mined land would be a welcome addition.

     c. If at all possible, a positive function should be chosen for the land. Should this function succeed, the land will be cared for and the public will not think of it as mined land.

  3. Some mining companies do the post-mining functions themselves, getting into the farming, Christmas tree, or similar business. Sale of a product from the mined land, or sale of the land itself can give economic benefit beyond that of reclamation cost reimbursement.

4. A not-so-obvious factor, but one that should be emphasized, is that the potential value of the land is that which it will have when stripping and reclamation are completed, not that it possesses at the time of planning. Thus, the time involved in mining should be considered along with the trends in land use in an area in determining potential value. For instance, a small community may not presently need an airport; but if the community is growing while mining proceeds, then an airport might be a welcome community addition in the near future. Likewise, a community that is beginning to undergo expansion would need, at the time mining ends, land to expand onto, or agriculture land to replace that which was taken by prior expansion, but not additional forest land.

IV. Pre-Stripping Reclamation Plans (In order to obtain a stripping permit, most states (Ref. 2) require a reclamation plan and a performance bond prior to permit approval. It behooves the operator to choose his ultimate land use before designing his reclamation plan. If possible, an acceptable--as defined in subsequent units--reclamation plan should be chosen to complement the desired land use. This choice is aided by the material in subsection III. A problem may arise if agriculture is the desired end use because a variance from the planting requirements will be required.)

V. Economics

A. Reclamation costs on abandoned mined land: When abandoned surface-mined land is restored to original conditions by government agencies or by demonstration groups (Ref. 3 & 4), the costs can be extremely high. One project, in Western Pennsylvania, reports average costs of $780 per acre for one type of land and $1,402 per acre for another (Ref. 3). A demonstration group in West Virginia spent $2,236 per acre to totally reclaim some contour-mined land (Ref. 4). These costs are typical if the land must be reclaimed after mining ceases. Obviously, these costs are in excess of any intrinsic value that the land may possess. It is noteworthy, however, that these costs are far in excess of what it would cost a mining company to do the same job.

UNIT #40 continued

B. Cost of reclamation within the mining plan: It is a little more difficult to guess at how much a mining company would pay for its reclamation, but the following points must be made. A mining company, compared with the projects above, does not have to pay moving costs for the equipment, clearing or grubbing costs for the land, or costs of access roads. Furthermore, inasmuch as reclamation is only one operation within the mining plan, the charges due to depreciation, supervision, and overhead can be reduced substantially for reclamation.

Additionally, if overburden is spoiled during mining so as to be in a good position for reclamation, the only additional earth-moving costs incurred by the mining company are for leveling peaks, lowering the highwall, and returning topsoil. Reclamation of the land to a level sufficient to support growth can cost no more than the going rate of agricultural land. Revegetation costs are additional, but methods delineated in later units can keep these costs down, too.

C. Profits from reclamation: As long as the law requires reclamation, the mining company should make every effort to profit from this activity. Any income derived from the reclaimed land can be used to offset the reclamation cost.

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1. Anonymous. 'Guide to Making Appraisals of Potentials for Outdoor Recreation Development," U. S. Department of Agriculture, Soil Conservation Service, 72 pp. (July 1966).
2. Anonymous. Study of Strip and Surface Mining in Appalachia: An Interim Report to the Appalachian Regional Commission, U. S. Department of the Interior, 78 pp. (June 1966).
3. McNay Lewis M. "Surface Mine Reclamation, Moraine State Park, Pennsylvania," U. S. Department of the Interior, Bureau of Mines Information Circular 8456, 28 pp. (1970).
4. Scott, Robert B., et al. "Cost of Reclamation and Mine Drainage Abatement--Elkins Demonstration Project," Preprint Number 70-AG-349, SME of AIME (October 21-23, 1970).

UNIT #40 continued

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UNITS #41-44

TITLE: Reclamation--Backfilling and Planting

PURPOSE: To provide basic information and case histories on backfilling and planting.

OUTLINE:

I. Types of Backfilling--Definitions

- A. Area
- B. Contour
- C. Terrace
- D. Block-cut

II. Type Selection

- A. Original slope
- B. One cut or multiple cuts
- C. One seam or multiple seams
- D. Ultimate use of land
- E. Prevention of soil erosion and mine drainage

III. Equipment Used for Backfilling

- A. Review previous presentations
- B. Bulldozers
- C. Draglines
- D. Scrapers
- E. Shovels
- F. High lifts

IV. Guidelines for Planting (Ref. 2)

- A. Soil analysis and characteristics
- B. Classification of strip-mine spoil
  - 1. Spoil groups
    - a. About 75 percent or more of spoil area is above pH 5.5 and not more than 25 percent of the area is below pH 4.0. This spoil group is predominantly from limestone overburden. Sweet clover, timothy, and pioneer-type native species seed in naturally on this spoil.
    - b. Less than 75 percent of the spoil area is above pH 5.5 but at least 75 percent is above pH 4.5. Not more than 25 percent of the area is below 4.0. This spoil group is predominantly from acid shales and sandstone overburden. Pioneer-type native plants seed in naturally, but include few legumes.

UNITS #41-44 continued

   c. About 50 percent or more of the spoil area is below pH 4.5, but not more than 50 percent is below pH 4.0. This spoil is characterized by a high percentage of pyritic material interspersed throughout the entire area. Pioneer plants occur only in scattered areas.

   d. More than 50 percent of the spoil area is below pH 4.0. This spoil is naturally high in pyritic material. This group is characterized by its bareness, erosion, and "slick" or wet acid areas.

2. Slope classes

   a. Level to steep (-0 to 25 percent)
   b. Very steep (more than 25 percent)

3. Stoniness

   a. Nonstony--will not interfere with seedbed preparation nor limit the use of mechanical tree planters.

   b. Very stony--surface or buried stones restrict seedbed preparation, but will not restrict tree and shrub planting by hand.

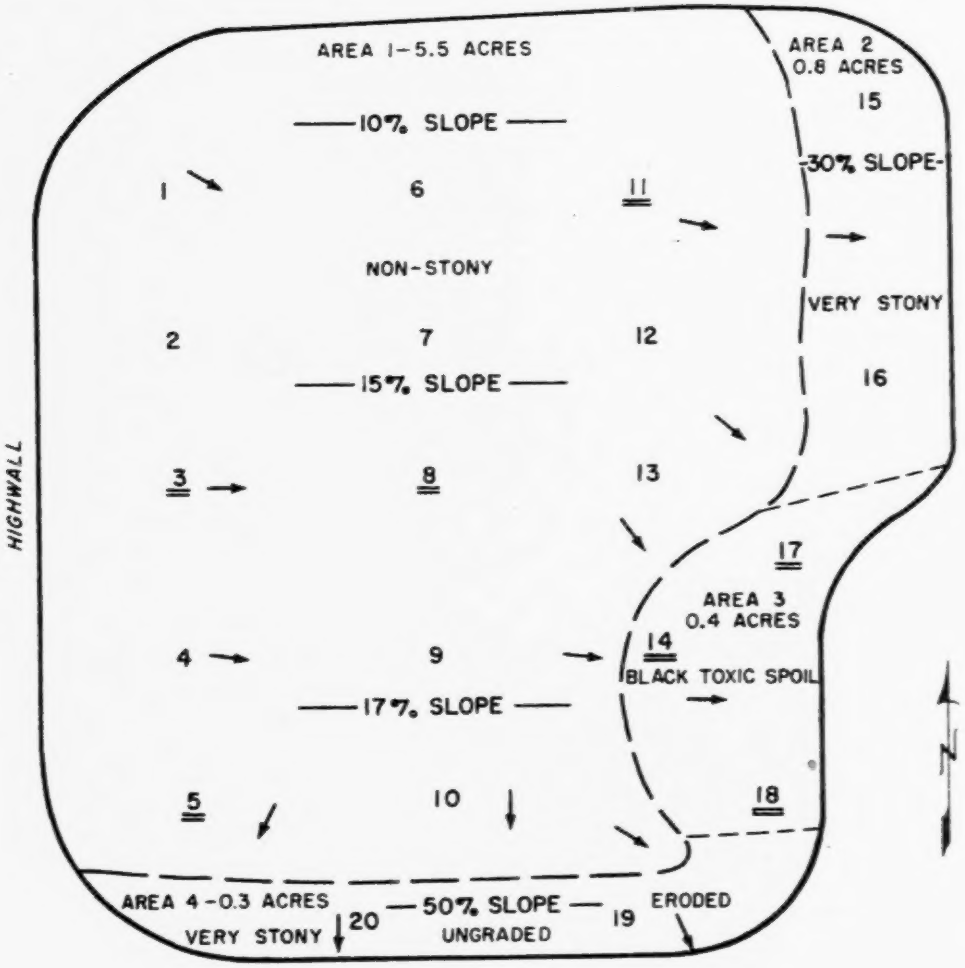
C. Revegetation planning

   1. Before strip mining
   2. After strip mining

      a. Acidity
      b. Compaction
      c. Stoniness
      d. Slope
      e. Color
      f. Erosion

   3. Preparation of map (See next page.)

UNITS #41-44 continued


AREA 1–5.5 ACRES
—10% SLOPE—
1
6
11
NON-STONY
2
7
12
—15% SLOPE—
HIGHWALL
3
8
13
4
9
—17% SLOPE—
5
10
AREA 2
0.8 ACRES
15
-30% SLOPE-
VERY STONY
16
17
AREA 3
0.4 ACRES
14
BLACK TOXIC SPOIL
18
N
AREA 4 - 0.3 ACRES
VERY STONY
20
—50% SLOPE—
UNGRADED
19
ERODED

1 - 5.0
2 - 5.0
3 - 3.1
4 - 4.5
5 - 3.5

6 - 5.3
7 - 5.0
8 - 3.0
9 - 4.5
10 - 4.5

11 - 3.4
12 - 5.3
13 - 5.3
14 - 3.3
15 - 5.0

16 - 4.5
17 - 3.0
18 - 3.0
19 - 4.5
20 - 4.2

JOHN DOE
SMITHVILLE, PA.

TOTAL ACRES-7.0

100 FEET

ACCORDING TO SPOIL TEST, 65% OF SPOIL IS BELOW pH 4.5, BUT NOT MORE THAN 35% IS BELOW pH 4.0.

SPOIL GROUP IS C

Figure 14.—A spoils-classification map.

SOURCE: Reference 2

UNITS #41-44 continued

4. Land Use

Table 2.—*Land use and recommended species*

GROUPS A AND B SPOIL MATERIAL

SLOPE Percent	STONINESS	LAND USE	GRASSES	LEGUMES	TREES	SHRUBS
0-25	Non-stony	Woodland Wildlife Recreation Cropland Hayland Pasture	Red fescue Tall fescue Orchardgrass Reed canarygrass Tall oatgrass Switchgrass Smooth brome Timothy Redtop Bluegrass Ryegrass	Alfalfa[2] Birdsfoot trefoil[3] Lespedeza sericea Crownvetch[4] White clover[3] Red clover[3]	Austrian pine Jack pine Pitch pine Red pine Scotch pine Virginia pine White pine Japanese larch European larch Black locust	Autumn olive Multiflora rose Tatarian honeysuckle Amur honeysuckle Arrowwood Silky dogwood Lespedeza bicolor[1] Rose acacia[1] Mugho pine
25+		Woodland Wildlife	Tall fescue Tall oatgrass Timothy Redtop Switchgrass Reed canarygrass Ryegrass	Birdsfoot trefoil[3] Lespedeza sericea Crownvetch[4]	Red oak[1] European alder Hybrid poplar Black locust	
All slopes	Very stony					
GROUP C SPOIL MATERIAL						
All slopes	All classes	Woodland Wildlife	Tall oatgrass Tall fescue Redtop	Lespedeza sericea	Austrian pine Jack pine Pitch pine Red pine Scotch pine White pine Japanese larch Black locust Red oak[1] European alder	Autumn olive Lespedeza bicolor[1] Mugho pine
GROUP D SPOIL MATERIAL (Note: growth and survival may be poor on these areas.)						
All slopes	All classes	Wildlife	Tall oatgrass[5] Redtop[5]	Lespedeza sericea[5]	Austrian pine[6] Pitch pine[6] Red pine[6] Black locust European alder	Autumn olive[6] Mugho pine[6]

[1] Species acceptable, but availability is very limited.

[2] Use on areas having a pH of 6.0 or above.

[3] Use on areas having a pH of 5.0 or above.

[4] Use on areas having a pH of 5.5 or above.

[5] Use on areas having a pH of 4.5 or above.

[6] Use on areas having a pH of 3.5 or above.

SOURCE: Reference 2

UNITS #41-44 continued

- D. Planting for woodland
  - 1. General considerations
    - a. Species
    - b. Quality of stock
    - c. Planting method
    - d. Spacing
    - e. Season
  - 2. Planting guide
    - a. Timber production
    - b. Christmas tree production
- E. Planting for agricultural uses
  - 1. General considerations
    - a. Spoil material
    - b. Time
    - c. Cost
    - d. Climate
  - 2. Planting guide
    - a. Hayland
    - b. Cropland
    - c. Pasture
- F. Planting for wildlife use
  - 1. General considerations
    - a. Soil conditions
    - b. Cost
    - c. Use
      - 1) Development
      - 2) Management
    - d. Species
      - 1) Suitability
      - 2) Availability
      - 3) Quality
    - e. Care of planting

UNITS #41-44 continued

2. Planting guide

    a. Type of species
    b. Spacing
    c. Time
    d. Pattern

V. Case Histories (Articles appear periodically in such journals as Mining Engineering, Mining Congress Journal, Coal Mining & Processing, and Coal Age. The lecturer on this subject must keep up to date and present the latest information on stripping and reclamation.)

A. "Peabody Looks at the Future of Surface Coal Mining," Mining Engineering, Volume 24, Number 10, pp. 53-6 (1972).

B. "Open Pit Mining," Mining Congress Journal, pp. 142-7 (February 1972)

C. "Steeply Pitching Seams Challenge Alabama Stripping," Coal Mining & Processing, Volume 9, Number 10, pp. 51-3 (1972).

D. "Reverse Mining in Kentucky Hills," Coal Mining & Processing, Volume 9, Number 6, pp. 49-51 (1972).

E. "Flat Top Stripping in Hill Country," Coal Mining & Processing, Volume 9, Number 4, pp. 86-9 (1972).

F. "Surface Mining--Reclamation," Coal Age, Volume 77, Number 7, pp. 181-2 (1972).

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2. Davis, Grant, et al. "A Guide for Revegetating Bituminous Strip-Mine Spoils in Pennsylvania," Northeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, 6816 Market Street, Upper Darby, Pennsylvania.

3. Anonymous. "Reclamation of Acidic Coal Mine Spoil With Fly Ash," Bureau of Mines Report of Investigations Number 7504, U. S. Department of the Interior (April 1972).

*Enclosed.

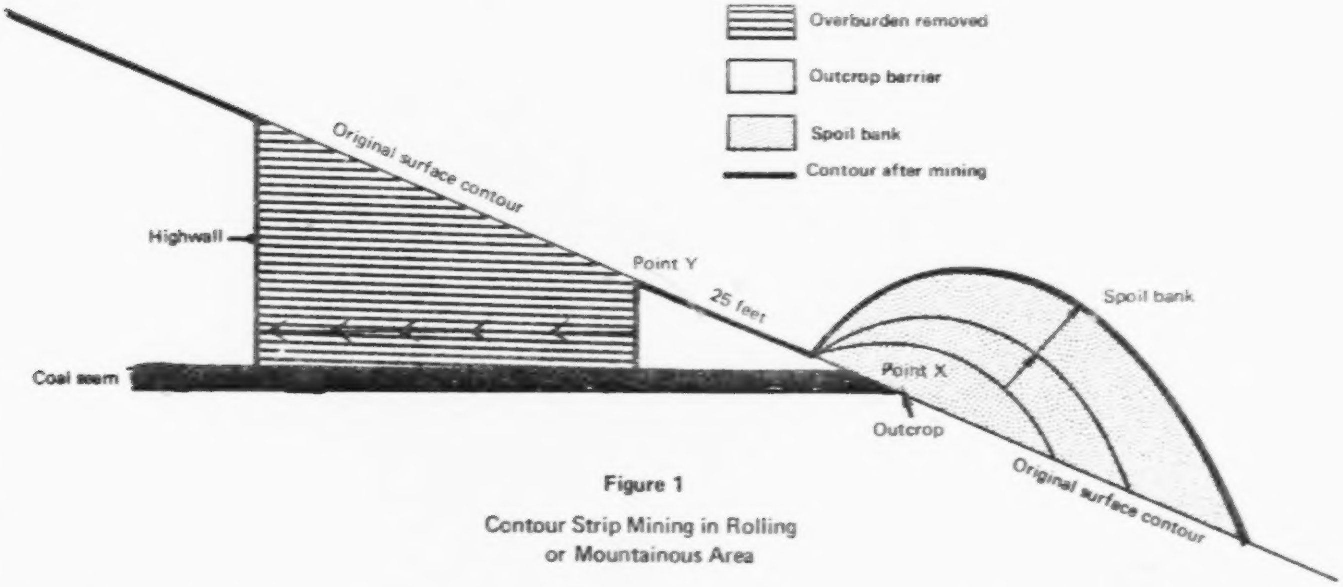


Figure 1

Contour Strip Mining in Rolling
or Mountainous Area

Requirements for Reclamation Projects

In order to understand the requirements that a Pennsylvania coal mine operator must meet in his reclamation project for a given mine site, it's necessary first to understand what the mine site looks like, and this in turn depends on what kind of terrain is involved and what kind of mining has been done.

Since contour strip mining of bituminous coal accounts for the largest number of acres requiring reclamation in Pennsylvania, we'll discuss that type first and then follow with a description of how operators reclaim sites that have been disturbed by the area strip mining of bituminous coal and the special type of strip mining used to extract anthracite.

Contour Strip Mining of Bituminous

Figure 1 shows in diagrammatic fashion what happens when contour strip mining takes place, usually in a rolling or mountainous area. Note that the coal seam (shown in black) is relatively flat and horizontal, and that there is an outcropping of coal at ground level on the hillside (Point X). In contour strip mining the process is one of cutting away the overburden and piling it in an increasingly larger spoil bank that overflows down the hillside. In Pennsylvania the operator is not permitted to begin mining at the point of outcrop (Point X). In order to contain any water which might accumulate in the pit floor–and this frequently continues to be a problem even after the pit has been filled during the restoration process–in Pennsylvania the strip-mine operator must leave the outcrop barrier in place (shown in gray in Figure 1), beginning his mining 25 feet higher up the slope at Point Y.

The mining operation continues, moving back into the hillside until the cost of removing overburden becomes so great that it's uneconomical to go farther. At that point we have the contour represented by the black lines in the top diagram in Figure 2 (Diagram A): a nearly vertical exposed highwall (which may rise 100 feet or more above the horizontal bench) and a spoil bank that has been cast down the hillside.

There are basically two ways to reclaim this kind of mine site: contour backfilling (shown in Diagram B) and terrace backfilling (shown in Diagram C). In general, Pennsylvania law requires that reclamation of bituminous strip mines must be to original contour (as shown in B), but that under special circumstances terrace backfilling (C) is permitted. Let's discuss them both in turn.

Contour Backfilling

In simplest terms, contour backfilling is a method in which the material in the spoil bank is used to fill in the big hole made during the mining. The 1963 Pennsylvania law requires that the material removed or disturbed during the extraction of the coal must be put back or replaced after the extraction is completed, and that this backfilling must be done to approximate original contour. This does not necessarily mean that the material must be put back in the same location from which it was removed, although this is desirable and may, as in the case of a one-cut operation, be the only way that an approximate original contour may be obtained.

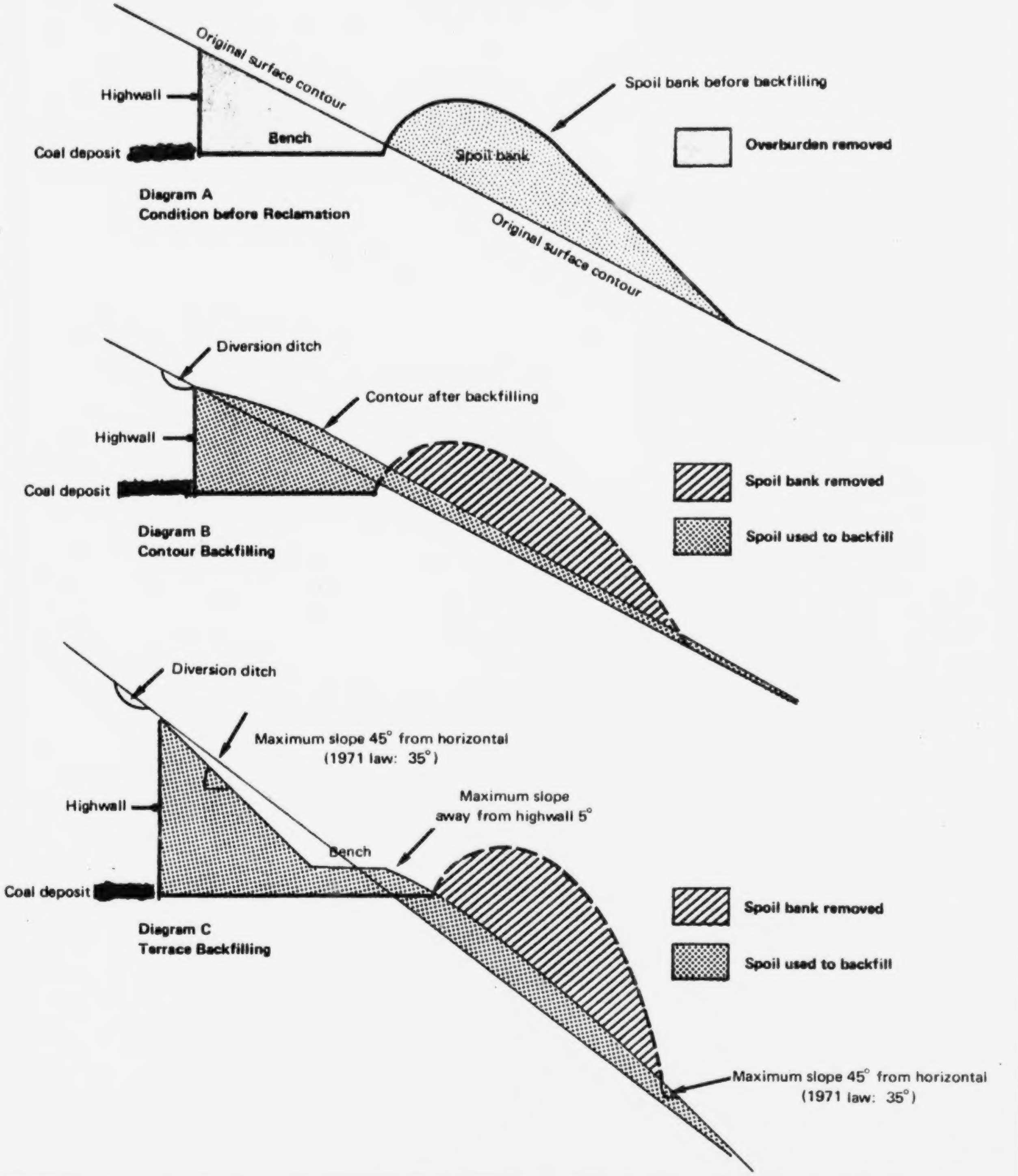
Furthermore, the requirement for approximate original contour does not mean that the final surface of the restored area will necessarily have the exact elevation of the original ground surface. This is practically impossible since the size of the spoil bank seldom is the same as the size of the hole from which it came. Usually the spoil bank is larger, because the extracted material swells when it is exposed to air and because the material is not as tightly compacted after removal. However, the spoil bank may be smaller than the excavation if a particularly large amount of coal has been removed. Recognizing this difficulty, the Pennsylvania law requires that the restored area should have approximately the same contour as it had originally.

In some cases the new contour may even be an improvement on the original condition of the land. For example, in some cases it is possible to strip mine–that is, to clip the tops off of–two adjacent hills and then to deposit the overburden in the valley in between; the result is that you have generated flat land where you never had any before. In a case like this, which is really a combination of terrace and contour backfilling, you finish up with new and more valuable real estate than when you started.

SOURCE: Reference 1

Figure 2

Contour Strip Mining



Original surface contour
Spoil bank before backfilling
Highwall
Bench
Coal deposit
Spoil bank
Overburden removed
Diagram A
Condition before Reclamation
Original surface contour
Diversion ditch
Contour after backfilling
Highwall
Coal deposit
Spoil bank removed
Spoil used to backfill
Diagram B
Contour Backfilling
Diversion ditch
Maximum slope 45° from horizontal
(1971 law: 35°)
Maximum slope
away from highwall 5°
Highwall
Bench
Coal deposit
Spoil bank removed
Spoil used to backfill
Diagram C
Terrace Backfilling
Maximum slope 45° from horizontal
(1971 law: 35°)

SOURCE: Reference 1

Another aspect of restoration of strip-mining sites—and this applies to both contour- and area-type operations—is the necessity for controlling the water that may accumulate at the site, water which can cause erosion and acid drainage. In order to prevent the accumulation of water, the operator is required to put a diversion ditch at the top of the highwall in order to divert upslope water away from the mining operation, that is, to keep the water from running downhill into the pit (see Diagrams B and C in Figure 2). In addition, if any water accumulates in the pit as the result of direct rainfall, the operator must routinely have the water pumped out and discharged through two sedimentation ponds in order to treat and settle any solids. If the water is acid, it must also be neutralized.

Terrace backfilling, which is illustrated in Diagram C of Figure 2, is generally permitted in Pennsylvania only in those instances where the land has a very steep contour. As a matter of fact, the state not only permits but actually prefers terrace backfilling in these situations, since you're apt to have more erosion problems with restored steep single slopes than you are with the gently sloped benches that you get when you use the terrace backfill method.

Terrace backfilling is essentially a method of restoration in which part of the spoil bank is used to fill in the highwall and part is used to reduce the slope of the spoil bank (see Diagram C). The resulting gentle slopes have a long, relatively flat table area (called the bench) in between. In Pennsylvania the guidelines for terrace backfilling are as follows:

☐ The steepest slope of the highwall and of the outer slope of the spoil bank shall be no greater than 45 degrees from the horizontal. (Under the new law the permitted slope is reduced to 35 degrees.) The outer ridge of the spoil shall be rounded off with machinery.

☐ The table portion of the restored area shall be a terrace which is either flat or sloping downward away from the highwall at an angle of not more than 5 degrees.

☐ There shall be no depressions to hold water and no lateral depressions or drainage ditches of sufficient length to cause erosion of the restored area.

☐ Lateral drainage ditches shall have a minimum width of 12 feet.

Area Strip Mining of Bituminous Coal

Area strip mining is practiced on relatively flat terrain (that with a slope of less than 12 degrees) where there is no outcrop of the coal seam. Because of the Commonwealth's topography there is relatively little of this kind of strip mining in Pennsylvania.

As shown in Figure 3, a trench or "box cut" is made by removing the overburden, which is deposited in a spoil bank on the opposite side of the trench. The coal is then removed, and the operation moves on to make the next parallel cut. As shown in Figure 4, as each cut is made, the overburden is deposited in the cut previously excavated. However, since there is usually some left-over spoil (because of the swelling and lack of compaction of the overburden), at the end of an area strip-mining operation the mine site usually looks like a gigantic washboard (see Figure 5) with a large spoil bank at the end of the first cut, smaller "left-over" banks between the succeeding cuts and an open trench at the last cut. There is frequently a

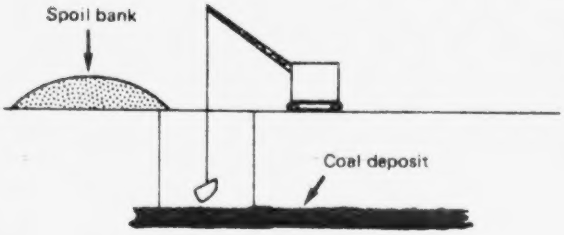


Figure 3

Area Strip Mining in Flat Terrain
(Slope less than 12°)

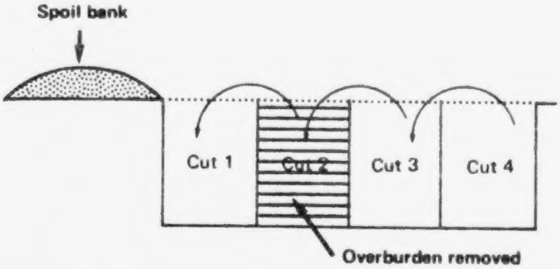


Figure 4

Successive Cuts in Area Strip Mining

Jan Faul

Front-end loader removing overburden in a bituminous strip-mining operation.

SOURCE: Reference 1

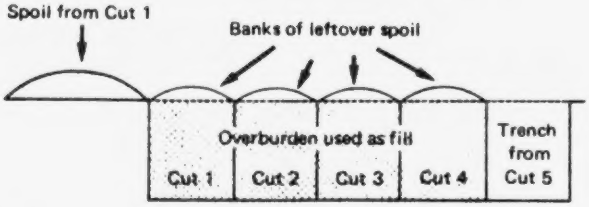


Figure 5

Results of Area Strip Mining

large distance—sometimes a mile or more—between the first-cut spoil bank and the last trench.

Restoration of this type of site is basically a process of leveling and grading. The first-cut spoil bank must be leveled so that the outside slope of the spoil will blend into the contour of the adjoining land. The smaller peaks from successive excavations are also leveled, and all this material is pushed toward the last cut, where it is deposited in the final trench. With this procedure, an approximate original contour will be obtained. Under Pennsylvania law, this work must be carried on while mining progresses; generally no more than 1,500 feet of cut may be open at any one time. The completed restoration may not have any highwall, any spoil peaks or any depressions that could hold water which might percolate through the spoil and produce acid drainage.

One of the major problems in strip mining is that it is difficult to be sure that the topsoil stays on top—and this difficulty becomes particularly evident in area strip mining. Unless preventive steps are taken, the soil layers deposited in Cut 1, for example, will be exactly the reverse of the way they come out of Cut 2: the topsoil will finish up on the bottom, and the heavy rocky lower layers will be the last to be put in. The environmental problems resulting from this topsy-turvy deposition are enormous and must be avoided. This is done by carefully removing the topsoil first and storing it separately while the underlying layers of subsoil and rock are removed and stored and the coal taken out. When the mining is completed, the overburden can then be put back in its natural sequence and the topsoil can be redeposited where its name tells us it belongs —at the top.

Block-Cut Method of Strip Mining

When strip mining is done in mountainous areas, particularly in areas where the soil is very unstable, one of the most damaging parts of the operation occurs when the overburden is cast down the hillside, where it frequently slips and slides, uprooting trees, blocking streams and roads and occasionally avalanching into homes and farms.

In the mountainous areas of Pennsylvania, another method of strip mining—a modified block-cut method—has been used to help minimize this kind of damage. It is a method which may have applicability in the mountainous areas of other mining states.

The block-cut method is basically the area method adapted for steep terrain. At a first-cut site which has been carefully chosen to minimize potential slide damage (shown diagramatically in Figure 6), an original box cut (Cut 1) is made into the hillside; the cut, which is customarily two to three times as wide as subsequent cuts, goes into the hill to the maximum depth that the operator intends to mine at any point around the hillside. A highwall is left, the overburden is dumped down the hillside in the traditional way and the coal is removed.

In all successive cuts, however, the overburden is *not* cascaded down the hillside; it is deposited in the void left by the previous cut. Once the original box cut has been made, mining operations can be continuous, working around the mountain in both directions from Cut 1. Figure 7 (on page 21), which shows a top view of a box-cut operation, illustrates how the mining operations move around the mountain; overburden from Cuts 2 and 3 is put into Cut 1 (Diagram C), overburden from Cut 4 into the void left from Cut 2 (Diagram D), from Cut 5 into Cut 3 (Diagram E) and so on. In all cuts after the first, an undisturbed mound or outcrop barrier is left to trap runaway spoil and mine water and prevent its movement down the hillside or into nearby streams. Figure 8, which shows a side view of Cut 2 after it has been filled with overburden from Cut 4, illustrates how these later cuts will look after the mining operation is completed.

The block-cut method is not without its problems. If only a small amount of coal is extracted and/or if the overburden is not easily compacted because the nature of the soil causes it to swell more than usual, there may be leftover spoil that can't be fitted into the cuts. In the case of area strip mining, where the same problem exists, the leftover hillocks can be "struck off" or smoothed over when the operation is finished. In mountainous areas, this won't work because the leftover spoil would go sliding down the hillside. In this situation the surplus spoil is contoured into terraces or carried away to other and flatter locations where it can be deposited and revegetated.

In block-cut mining the problem of saving topsoil is both more and less difficult than it is in the area strip mining done in flatter areas—more difficult because it's harder to find a place

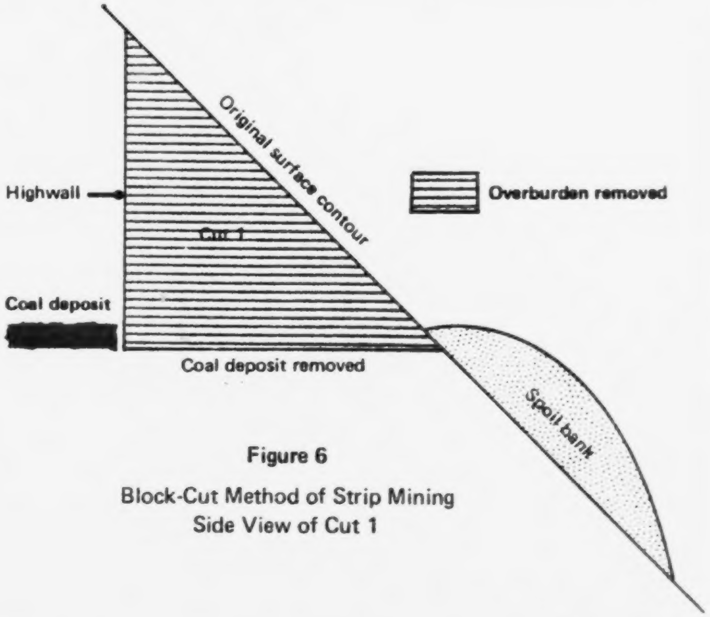


Figure 6

Block-Cut Method of Strip Mining
Side View of Cut 1

SOURCE: Reference 1

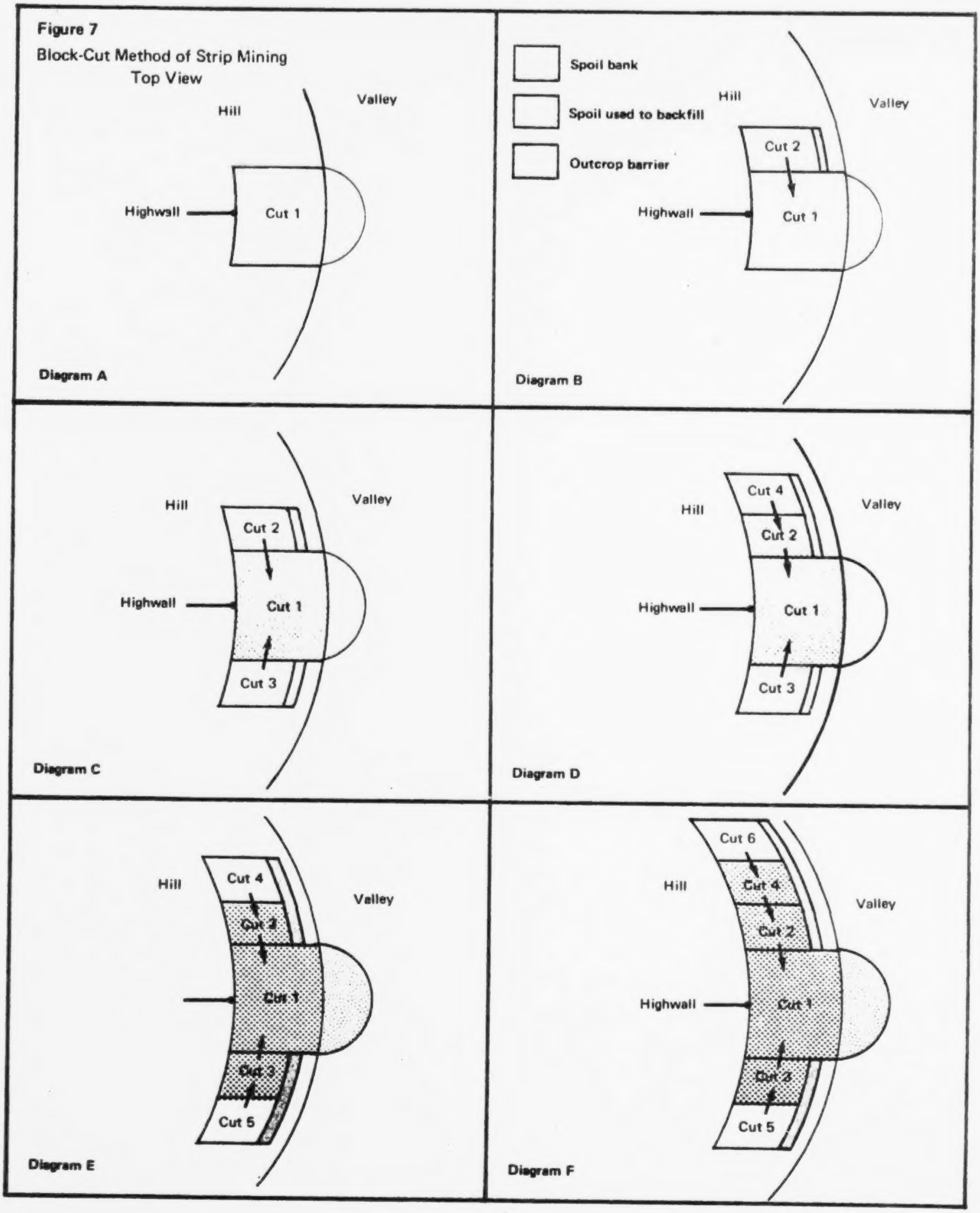


Figure 7

Block-Cut Method of Strip Mining
Top View

Spoil bank
Spoil used to backfill
Outcrop barrier
Hill
Valley
Highwall
Cut 1
Cut 2
Cut 3
Cut 4
Cut 5
Cut 6
Diagram A
Diagram B
Diagram C
Diagram D
Diagram E
Diagram F

SOURCE: Reference 1

Before

During

After

Bureau of Mines, U.S. Department of the Interior

Bituminous strip-mine reclamation demonstration project near DuBois.

SOURCE: Reference 1

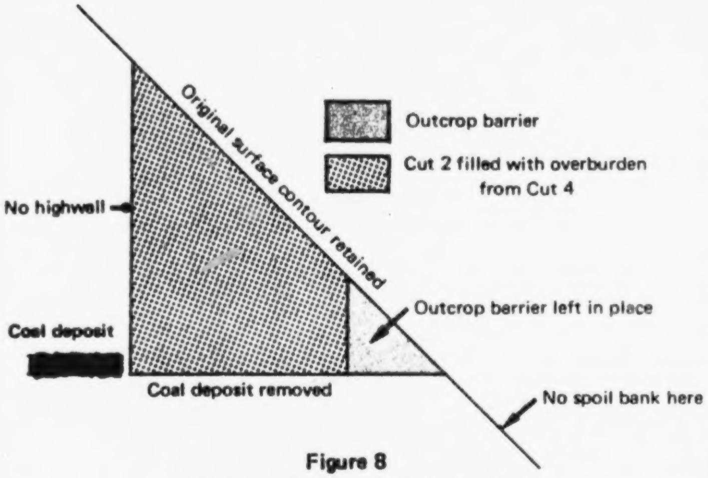

Original surface contour retained
Outcrop barrier
Cut 2 filled with overburden from Cut 4
No highwall
Outcrop barrier left in place
Coal deposit
Coal deposit removed
No spoil bank here

Figure 8

Block-Cut Method of Strip Mining
Side View of Cut 2 after
Filling with Overburden from Cut 4

to store the topsoil, and less difficult because the layers of topsoil are usually much thinner in mountainous areas. In both area and block-cut mining, however, the topsoil must be stored for only a short time because of the continuous cut-and-fill type of mining procedure used in both. In mountainous areas the topsoil can be temporarily stored on the ledge between the top of the highwall and the diversion ditch.

Revegetation

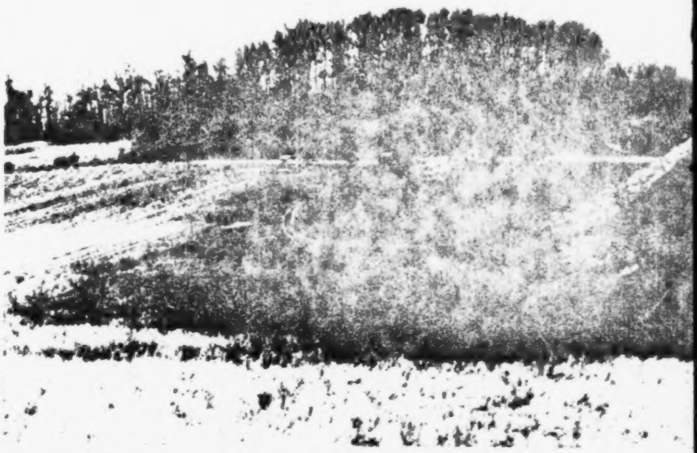
The next step in mine site restoration is revegetation.

After a mine operator has completed the backfill work on a given bituminous mine site, and has received DER approval of that work, he can apply for and receive partial release of his bond. DER, however, retains a portion of the bond in order to assure that the operator will then revegetate the site properly. For this part of the restoration job the operator has had two options: either paying the state to do the revegetation (in which case the remainder of his bond is immediately released) or doing it himself. Most operators opt for the latter. (The former option is no longer available to operators, since it was eliminated in the new 1971 law.)

In Pennsylvania the vegetation projects must meet the following requirements:

(1) Under the supervision of a DER forester, *the operator must supply analyses of soil samples from the mine site.* Analysis of a "grab sample" isn't enough to meet this requirement. The operator must furnish analyses of soil taken from a scientifically designed array of sampling points (usually at least five) to give DER a real feel for how acid the soil is and what sorts of nutrients are needed to restore it. The samples are tested, usually by The Pennsylvania State University, and on the basis of their evaluation DER stipulates which soil nutrients (commercial fertilizer containing potassium, phosphates and nitrates) and lime must be added, and in what quantities. The operator may choose any brand of commercial fertilizer he wishes, so long as it contains the proper quantities of nutrients and is applied so many pounds or tons to an acre, as specified by DER.

(2) *The operator must then plant vegetation on the strip-mined site.* Prior to November of 1970, the operator had the option of planting either trees, grass or a grazing crop such as clover. Since planting trees costs less than planting grass—approximately $45 per acre for trees (on the basis of spacing them six feet apart) as compared with $90 per acre for grass—most operators opted to plant trees, which have many advantages but which do not prevent soil erosion during their early years of life. In November of 1970, however, the Pennsylvania legislature passed an act which had been drafted at the suggestion of the Soil Conservation Commission. Under this law, DER is empowered to require that the operator plant both grass and trees. This requirement might be applied, for example, in very hilly terrain, or in other situations where DER determines that it is necessary to do both types of planting in order to prevent erosion.



Jan Faul

The three faces of strip mining in Butler County. Right to left: mining in progress, reclamation going on, completely restored area. Note strip of straw (at left) used to mulch land in order to prevent erosion.

Jan Faul

Vegetated areas in foreground and far background of this Jefferson County farm are reclaimed strip-mine sites.

SOURCE: Reference 1

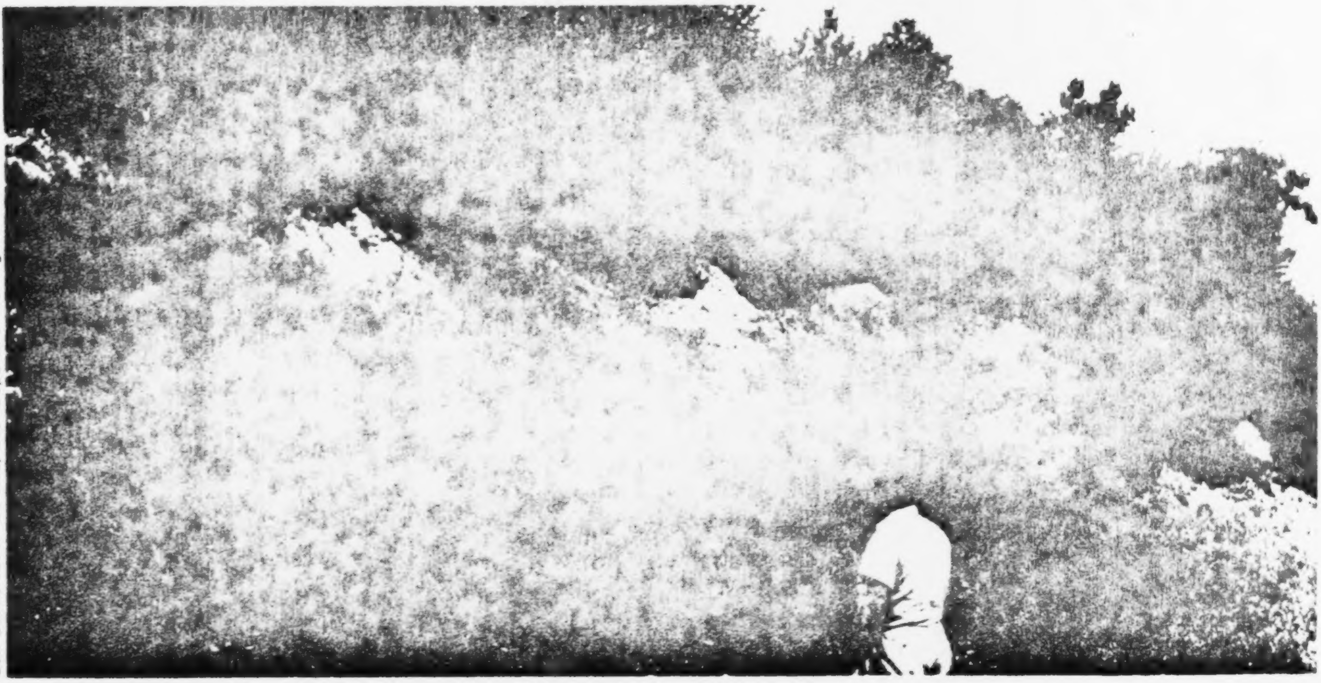
If DER requires the planting of grass, the whole mine site area must be seeded as soon as the backfilling operation has been completed. On the basis of recommendations from the forester, DER specifies the species and quantity of grass seed that must be planted. Since passage of the 1970 law, a mixture of annual and perennial grasses has been used. This type of mixture has a number of advantages. It furnishes "instant green," it keeps the soil from running down the hillsides and it does not have to be replanted the following season.

If DER approves revegetation with trees (either alone or in combination with grass), the operator usually waits until spring to do his tree-planting. The reason for the delay is that research has shown that trees, shrubs and bushes survive best if they are planted in the spring (80-percent survival as compared with 65-70 percent if planted in the fall and only 50 percent in summer or winter). The operator has his choice of what he plants, as long as it's from the DER-approved list. (The list has been published on page 15 of *A Guide for Revegetating Bituminous Strip-Mine Spoils in Pennsylvania*; copies of this booklet may be obtained free of charge by writing to the Mine Drainage Section, Division of Mine Reclamation, Department of Environmental Resources, P.O. Box 2063, Harrisburg, Pennsylvania 17105.)

The bushes and trees on this list have been selected for their acid resistance (since most of the soil in reclaimed mine sites may be acid), for their ability to survive on certain types of terrain, for their resistance to aluminum and iron compounds (which are often found in strip-mine spoils and which are toxic to plant life) and for their speed of growth. The choices are usually based on the results of DER-sponsored research, most of which has been done by the U. S. Forest Service and Penn State; DER has research contracts with both of these organizations.

Pennsylvania is generally covered with deciduous hardwood trees–trees that drop their leaves every fall. So for many years the only trees on the DER list were softwoods such as pine and spruce; mine site reclamation was used as a method of getting more variety in the type of trees growing in the Commonwealth, and hence more variety in the type of pulpwood that could be produced commercially. More recently, however, research results have shown that some of the hardwoods grow faster, that they are in demand for pulp, that they make good cover and food for game and that they help put nitrogen back in the soil. A number of hardwoods have therefore been added to the DER list during the last few years.

If the mine site has very porous soil and is in a particularly wet area, planting water-hungry vegetation can help prevent acid mine drainage. For this reason, DER may require that the operator plant something which has a great ability to draw moisture out of the soil and get it out into the atmosphere by transpiration (evaporation from the leaves). One new plant is the bristly locust, which was developed by the U.S. Soil Conservation Service during the last two and one-half or three years and which is being planted in steeply sloped mine site areas where trees cannot be grown effectively. Although it has no commercial utility, it takes up a lot of water, grows fast, furnishes cover for small game and serves as food for small animals (who eat the berries) and deer (who eat the foliage). The foliage grows back quickly, and the berries are bright red; so bristly locust makes attractive cover. For these reasons, DER has sometimes recommended its use in moisture-heavy areas



Soil Conservation Service, U.S. Department of Agriculture

Bituminous strip-mine backfill planted with Christmas trees near Kittanning.

SOURCE: Reference 1

and on hillsides where there isn't any real possibility of turning the site into a tree-farm kind of operation.

Which brings us to the commercial aspects of mine site revegetation. Whether or not the operator (or landowner, if they're two separate people, as they often are) uses the site to grow a crop of some kind is up to him; DER is concerned only with improving the appearance of the site, preventing pollution and bringing the land back into condition so that it can serve some useful purpose. Some strip-mined land, particularly that in central Pennsylvania in the Indiana-Cambria County area, has been developed into Christmas tree plantations. This has worked well because Scotch pines are very acid-tolerant and you can count on roughly a foot of growth a year. This means that if, after you finish strip mining, you plant two-year-old seedlings, five years later you can be harvesting a crop of Christmas trees.

There's another species of tree that has a good chance of making a quick turnaround profit for the operator or landowner. It's called a hybrid poplar, and it will grow as much as two and a half to three feet a year, which means that it can grow into good-quality commercial pulpwood size in ten years—and in the forestry business this is very good indeed.

DER is also doing some research on the possible use of Ponderosa pine, a fast-growing timber tree (that is, one used to produce lumber for building) that grows in acid soil out in the Rocky Mountains. Cones have been imported from New Mexico, and DER will determine whether this species will also flourish in Pennsylvania.

At present there is some discussion between agronomists and foresters as to when or whether DER should require the planting of both grasses and trees. When trees are planted, their first roots spread out horizontally in the topsoil; it is only after two or three years that they start sinking deeper roots to obtain moisture and food. Because of this early dependence on topsoil, some foresters claim that the young trees will suffer if grass has also been planted, since there will be more competition for nutrients and water. On the other hand, the grass does furnish "instant green," and it does prevent erosion. So at present DER is frequently recommending that operators put down strips of grass and trees, one alternating with the other in a pattern similar to contour plowing, and that this be done regardless of the terrain. (The grass strips are planted immediately after completion of backfilling; the tree strips are left fallow until the next spring planting season.) This solution seems to work very well, combining the benefits of both types of ground cover.

There's another form of crop that can be grown on mine site land, and that's the agricultural crop that was grown before the mining took place. In certain counties, such as Somerset and Jefferson, where the land is relatively flat and we therefore find Pennsylvania's closest approximation to area strip mining, the mine operator frequently obtains the right to do strip mining by contracting with the landowner, who has been using the land to grow crops. As part of the royalty agreement betweeen the two, the operator in the past often agreed to strip off the topsoil, stockpile it and then, after the mining has been done and the normal reclamation work completed, to redistribute the topsoil on top of the normal fill. (Under the new 1971 law operators are required to save and spread topsoil in all strip-mining operations.) With this kind of procedure, the land can be back in crops a year after the strip mining is completed. One excellent example of this kind of restoration is a potato farm in Somerset County; on August 30-31, 1972, this farm will be the site of the state's annual "Agriculture Progress Days," which attract crowds of 25,000, including agricultural agents from all over the Commonwealth. On that one farm visitors will be able to see an exhibition which includes:

Spot A: potatoes growing before mining takes place
Spot B: a strip mine in operation
Spot C: restoration work under way
Spot D: growing potatoes again
and
Spot E: a potato-chip factory.

Of course, this kind of crop-after-strip is possible only where the area was previously farmland, but there are many parts of the state where this kind of restoration is possible and where it is being carried on today.

Let's go back again to the operator and his bond. Once he has done the soil testing, has put on any required soil amendments (lime and fertilizers) and has completed the required revegetation in grasses and trees, he can apply for release of his bond. DER regulations specify that, before the bond is released, the forester must determine only that the planting has been done "in a workmanlike manner"; there are no requirements that a specified percentage of trees or bushes must survive for a given period of time. DER officials report, however, that where the plantings pass the "workmanlike manner" test, survival rates one year after planting are usually in the neighborhood of 85 percent.

How does a mine site look after revegetation as compared with the way it looked before the mining was done?

Of course, this depends on the particular mine site—they vary somewhat. But generally most of the mining land in Pennsylvania was or is originally in what we call scrub or tertiary woodland—woods that have been cleared a couple of times and then allowed to regrow naturally. After the mining is complete, a mixture of annual and perennial grass is planted, and the area soon looks like a grassy field. It will then follow the normal pattern of growth and coloration—fresh green grass each spring, brown dead grass during the winter. In some areas, volunteer or self-seeded trees may also appear on the restored site.

If trees are planted, it will be several years before they start showing to any significant degree. From then on, the area will look like a tree plantation, with young saplings of uniform size planted in uniform rows and growing at uniform rates.

SOURCE: Reference 1

UNIT #45

TITLE: Reclamation--Other Uses

PURPOSE: To stimulate thought over specific end uses for surface mine reclaimed land. It will also present specific operating techniques to aid in the reclamation necessary to prepare for these uses.

OUTLINE:

I. Introduction: By listing various end uses for surface-mined land and their associated reclamation techniques, it is hoped that operators will be able to improve their economic return from this land. The end uses which will be discussed are as follows.

II. Agriculture

A. The major requirements of agricultural land

1. Absence of soil toxins--primarily acid
2. Absence of large boulders
3. Presence of topsoil with sufficient nutrients
4. Minimization of erosion
5. Absence of steep slopes

B. To insure these qualities, reclamation that is concurrent with mining should follow these steps.

1. Any acid-producing material should be buried or sealed.

a. Seal the coal seam with clay or with polyethylene sheeting held down by layer of soil.

b. Place acid-bearing spoil in the bottom of the pit when backfilling. Many rock strata above the coal contain pyrites (acid-forming). These should be spoiled toward the bottom of the pit.

1) This can be done in area mining by "one-over" casting of clean spoil--place upper, acid-free spoil one strip over from the active strip and use the adjacent strip to place the acid spoil.

2) In contour mining, the acid material can be stacked against the highwall and then covered with acid-free material.

2. Shape, or contour, the surface to be gently rolling.
    a. Where possible, avoid steep slopes or valleys.
    b. In steep terrain, terracing will increase the amount of tillable land.
    c. Mountain-top removal and valley-fill are methods for hilly regions which increase flat land space.
3. Return topsoil.
    a. Topsoil should have been stripped prior to mining and stored.
    b. Stripping and return is done easiest with "pan" or "bowl" scrapers. If these are not available, the soil can be pushed with bulldozers or road graders, or loaded with front-end loaders into trucks.
    c. The elevating scraper is a small, self-contained unit (needs no pushers) which is good for this job.
4. Replant any unavoidable steep slopes promptly to minimize erosion. Trees such as hybrid poplar will give a good wind break to reduce wind loss of topsoil.
5. Prepare the soil (nutrients, lime) according to directions provided by local soil conservation office.
    a. If the land is to be used for grazing, plant the necessary grasses and shrubs.
    b. Avoid any species that would affect the grazing animals (onion or garlic grass, for example).

III. Woodland (The major requirements of woodland are similar to those of agricultural land, except that it is not necessary to have as ready access to the land and the land can be steeper.)

UNIT #45 continued

- A. Any acid-producing material should be buried or sealed.
- B. Return the surface to original contour, except where problems of erosion or, conversely, of water stagnation, occur.
- C. Return topsoil.
- D. Replant with the desired species. Since best growth may be stimulated by a fairly wide spacing, initial soil stabilization may be achieved by a quick-growing, self-limiting grass cover.
- E. Maintain nutrient level and pH during growth to assure success.
- F. Cultivate trees where necessary.
    - 1. Thin those trees that overcrowd.
    - 2. Shear or prune Christmas trees.

IV. Wildlife Refuge (The primary difference between gamelands and ordinary forest land is the type of vegetation.)

- A. Select vegetation that will provide good feeding areas.
- B. Alternate strips of grasses with strips of shrubs and low trees.

V. Recreation (The type and degree of reclamation will depend strictly on the kind of recreation that is envisioned.)

- A. Hunting, fishing, camping, hiking, etc.
    - 1. Reclaim as for forest land.
    - 2. Any projected bodies (lakes and streams) of water must not be allowed to come in contact with acid material.
    - 3. Lake and stream beds should be well sealed.
- B. Golf course (A golf course can be planned where the land is not too steep, as is the case in area mining.)
    - 1. Exact contours should be planned with a golf course consultant so that the land is ready for the construction of greens, tees and traps.
    - 2. Good, nutritious topsoil must be available for vigorous grass growth.

UNIT #45 continued

C. Ski and snowmobile areas (Where steep slopes are available in traditional snow areas, ski or snowmobile trails can be planned.)

  1. Cross-country skiing and snowshoeing are regaining popularity.

  2. Reclaim as for forest land, but allow for roads and trails.

VI. Housing

  A. A full-scale subdivision may be too big for all but the largest area-mined lands. However, many locales require additional land for trailer parks.

  B. Land should be reclaimed as for agriculture so that soil erosion is minimized and flat, stable area for construction is maximized.

VII. Disposal sites (It has been argued that when a strip mine is backfilled, an opportunity exists to bury unwanted material simultaneously. Properly executed, this is a good idea, but there are many pollution aspects that must be countered. Primarily, if the pit is used for sanitary landfill (garbage disposal) it must be realized that the metals in the garbage can contribute toxins which are worse than mine acid. Therefore, the flow of surface and ground water must be determined before a pit is used as a landfill.)

  A. Sanitary landfill

    1. Evaluate water conditions.

      a. Is the pit normally dry?
      b. Is the pit sealed from the water table by impervious layers?
      c. These questions should be answered yes if the pit is to be used for landfill.

    2. Dispose of any acid-bearing spoil. The pit should not be used for sanitary landfill if acid rock is going to be displaced and, hence, remain exposed.

    3. Operate the landfill in accordance with local regulations.

    4. Final backfill with mine spoil.

    5. Return topsoil.

6. Revegetate as in previous schemes.
    a. There is no reason why sanitary landfill cannot be used for a variety of post-fill uses.
    b. It must be remembered, though, that decaying matter releases marsh gas.

B. Mine waste disposal

1. In areas where it is difficult to spoil overburden because of proximity to roads or steep slopes, it is wise to check if there are existing strip mines that can accept the material. For instance, if an orphan mine exists nearby, excess spoil can be used to reclaim it.
2. The possibility exists that money from the reclamation fund can be contributed to this activity.

VIII. Industrial and Other Uses (When land for commercial development is scarce, reclamation for industrial uses should be considered. If mining was allowed, there should be no problem with zoning regulations conflicting with commercial use.)

A. Industrial park

1. Flat land and good transportation links are prerequisites for industrial parks.
2. Land contours should be right for a rail siding; that is, grades along the right of way should be less than three percent.
3. Revegetation is not a major concern, but there should be enough topsoil available to support some decorative growth.

B. Airport

1. Emergency landing strips and general aviation airports are welcome additions to many areas.
2. Federal Aviation Administration guidelines should be followed for runway lengths and widths.
3. Reclamation should produce flat land that is either covered with grass or paving.

4. Airports require clear landing paths and a freedom from gusty winds.

C. Miscellaneous (The unit leader may be familiar with specific industrial requirements that are particular to his area and should include them here.)

REFERENCES:

There is no text for this unit. Specific references to backfilling or planting techniques are listed in Units #40 to 44. The lecturer should be the same as in the other reclamation units.

APPENDIX A

APPENDIX A
REFERENCE BOOKS

MINING:

1. Brawner, C. O. and V. Milligan, Editors. Stability in Open Pit Mining, Proc. of the First International Conference on Stability in Open Pit Mining, Vancouver, B.C., Canada, November 23-25, 1970, Society of Mining Engineers of The American Institute of Mining, Metallurgical, and Petroleum Engineers.

2. Hartman, Howard L., Editor. Case Studies of Surface Mining, Proc. of the Second International Surface Mining Conference, Minneapolis, Minnesota, September 18-20, 1968, Society of Mining Engineers of The American Institute of Mining, Metallurgical, and Petroleum Engineers.

3. Jones, Donald C. and Myles E. Altimus, Jr. Mechanized Mining Electrical Applications, Second Edition, The Pennsylvania State University, University Park, Pennsylvania, 1951.

4. Nichols, Herbert L., Jr. Moving the Earth, Second Edition, North Castle Books, Greenwich, Connecticut, 1962.

5. Pfleider, Eugene P., Editor. Surface Mining, The American Institute of Mining, Metallurgical, and Petroleum Engineers, New York, 1968.

6. Sinclair, John. Quarrying, Opencast and Alluvial Mining, Elsevier Publishing Company Ltd., New York, 1969.

7. Woodruff, Seth D. Methods of Working Coal and Metal Mines, Vol. 3, Pergamon Press, New York, 1966.

8. Altimus, Myles E., Jr. Hydraulics in Mining Equipment, Parts I & II, The Pennsylvania State University, University Park, Pennsylvania, Part I--1968 (Second Edition) and Part II--1956.

9. Basal, Paul R., Jr., Editor. Mobile Hydraulics Manual, M-2990-S, Vickers Mobile Division of Sperry Rand Corporation, Troy, Michigan, 1971.

10. Industrial Hydraulics Manual, 935100-A, Revised Edition, Vickers Mobile Division of Sperry Rand Corporation, Troy Michigan, 1971.

TRAINING:

1. A Training Program in Manager's Safety Techniques for Supervisors in Coal, Metal, and Allied Industries, United States Department of the Interior, Bureau of Mines, Health and Safety District B, Mount Hope, West Virginia.
2. Bienvenu, Bernard J. New Priorities in Training, American Management Association, Inc., 1969.
3. Bittel, Lester R. What Every Supervisor Should Know, McGraw-Hill Book Company, New York, 1968.
4. Craig, Robert L. and Lester R. Bittel, Editors. Training and Development Handbook, American Society for Training and Development, McGraw-Hill Book Company, New York, 1967.
5. Mager, Robert F., Developing Attitude Toward Learning, Fearon Publishers, Palo Alto, California, 1968.
6. So You Want to Be a Supervisor, American Management Association, Inc., New York, 1971.

SAFETY:

1. "Basic Guide to Safety Management," Occupational Hazards Magazine, The Industrial Publishing Company, Division of Pittway Corporation, 1961 and 1962.
2. "Guide to Plant Fire Protection," Occupational Hazards Magazine, The Industrial Publishing Company, Division of Pittway Corporation, 1964 and 1965.
3. Handbook of Accident Prevention for Business and Industry, Fourth Edition, National Safety Council, Chicago, Illinois, 1970.
4. Heinrich, H. W. Industrial Accident Prevention, McGraw-Hill Book Company, New York, 1959.
5. Petersen, Dan. Techniques of Safety Management, McGraw-Hill Book Company, New York, 1971.
6. Supervisor's Safety Manual, National Safety Council, Chicago, Illinois, 1967.
7. "Techniques of Safety Management," Occupational Hazards Magazine, The Industrial Publishing Company, Division of Pittway Corporation, 1968 and 1969.
8. Gardner, James E. Safety Training for the Supervisor, Addison Wesley Publishing Company, Washington, D.C., 1969.

APPENDIX B

APPENDIX B
MAGAZINES

MINING:

1. Coal Age, July 1970, McGraw-Hill, Inc., New York.
2. Coal Mining & Processing, Volume 9, Number 7, July 1972, Maclean-Hunter Publishing Corporation, Chicago, Illinois.
3. Mining Congress Journal, Volume 58, Number 2, February 1972, American Mining Congress, J. Allen Overton, Jr., Publisher, Washington, D. C.
4. Mining Engineering, Volume 24, Number 9, September 1972, Society of Mining Engineers of The American Institute of Mining, Metallurgical, and Petroleum Engineers, New York.

TRAINING:

1. Training and Development Journal, Volume 24, Number 12, December 1970, American Society for Training and Development, Straus Publishing Company, Madison, Wisconsin.
2. Training in Business and Industry, Volume 8, Number 6, June 1971, Gellert Publishing Company, New York.

SAFETY:

1. National Safety News, November 1970, National Safety Council, Chicago, Illinois.
2. Occupational Hazards, June 1972, Industrial Publishing Company, Division of Pittway Corporation, Cleveland, Ohio.

APPENDIX C

APPENDIX C
ASSOCIATIONS

MINING:

1. American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc.
   345 East 47th Street
   New York, New York 10017

2. American Mining Congress
   1100 Ring Building
   Washington, D. C. 20036

3. Bituminous Coal Operators' Association
   918 16th Street, N.W.
   Washington, D. C. 20006

4. Mining Electrical Mechanical Maintenance Association
   c/o Leroy Evans
   212 Courland Road
   Indiana, Pennsylvania 15701

5. National Coal Association
   Coal Building
   1130 Seventeenth Street, N.W.
   Washington, D. C. 20036

TRAINING:

1. American Management Association
   135 West 50th Street
   New York, New York 10020

2. American Society of Training and Development
   P. O. Box 5307
   Madison, Wisconsin 53705

3. Mineral Engineering Department
   The Pennsylvania State University
   118 Mineral Industries Building
   University Park, Pennsylvania 16802

SAFETY:

1. Institute of Public Safety
   The Pennsylvania State University
   310 Shields Building
   University Park, Pennsylvania 16802

2. National Safety Council
   425 North Michigan Avenue
   Chicago, Illinois 60611

3. State safety council located in any particular state.

APPENDIX D

APPENDIX D
SOURCES OF FILMS

MINING:

1. Joy Manufacturing
   c/o John Mahaffey
   525 Buffalo Street
   Franklin, Pennsylvania 16232

2. Bureau of Mines
   United States Department of the Interior
   4800 Forbes Avenue
   Pittsburgh, Pennsylvania 15213

3. Modern Talking Picture Service
   2009 North Third Street
   P. O. Box 3035
   Harrisburg, Pennsylvania 17105

4. The Pennsylvania State University
   Audio Visual Services
   7 Willard Building
   University Park, Pennsylvania 16802

TRAINING (MANAGEMENT DEVELOPMENT):

1. American Management Association
   135 West 50th Street
   New York, New York 10020

2. BNA Films
   Division of The Bureau of National Affairs, Inc.
   5615 Fishers Lane
   Rockville, Maryland 20852

3. The Pennsylvania State University
   Audio Visual Services
   7 Willard Building
   University Park, Pennsylvania 16802

4. Roundtable Films, Inc.
   321 South Beverly Drive
   Beverly Hills, California 90212

TRAINING (MAINTENANCE):

Joy Manufacturing
c/o John Mahaffey
525 Buffalo Street
Franklin, Pennsylvania 16232

SAFETY*

1. National Safety Council
   425 North Michigan Avenue
   Chicago, Illinois 60611
2. The Pennsylvania State University
   Audio Visual Services
   7 Willard Building
   University Park, Pennsylvania 16802
3. Various state safety councils

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*In most areas, safety and management films can be borrowed or rented from the local electric, gas or telephone companies.

APPENDIX E

APPENDIX E
SPECIFIC FILMS

FILMS DEALING WITH SURFACE MINING:

1. "A New Concept in Mining"

Available from: Rome Luedtke
Bucyrus Erie Company
Sales Promotion Division
South Milwaukee, Wisconsin 53172

2. "Where Capability Counts"

Available from: Rome Luedtke
Bucyrus Erie Company

3. "Modern Bulk-Loading of High Energy Explosives"

Available from: Hercules, Inc.
Advertising Department
Wilmington, Delaware 19899

4. "Progress 5760"

Available from: Arthur J. Radwin
Manager--Communications
Marion Power Shovel Company, Inc.
Marion, Ohio 43302

5. "Marion 8800"

Available from: Marion Power Shovel Company, Inc.

6. "M-5 Drill"

Available from: Marion Power Shovel Company, Inc.

7. "7820 Walking Dragline"

Available from: Marion Power Shovel Company, Inc.

8. "7920 Walking Dragline"

Available from: Marion Power Shovel Company, Inc.

9. "Energy and The Environment"

Available from:
John W. Scales, Vice President
AMAX Coal Company
105 South Meridian Street
Indianapolis, Indiana 46225

10. "Basic Blading"

Available from:
Modern Talking Pictures Services, Inc.
Caterpillar Film Library
160 East Grand Avenue
Chicago, Illinois 60611

FILMS DEALING WITH THE APPLICATION OF HYDRAULICS:

1. "The Hidden Giant"

Available from:
Vickers Division
Sperry Rand Corporation
P. O. Box 302
Troy, Michigan

2. "Harnessing Liquids"

Available from:
Shell Oil Company
District Offices

3. "Hydraulic Transmission of Power"

Available from:
Shell Oil Company
District Offices

4. "Cavitation"

Available from:
Shell Oil Company
District Offices

5. "Hydraulic Oils"

Available from:
Texaco, Inc.
District Offices

6. "Rando HD"

Available from:
Texaco, Inc.
District Offices

7. "Hydraulic Systems"

   Available from: Mobil Oil Corporation
   District Offices

8. "Hydraulics at Work"

   Available from: Mobil Oil Corporation
   District Offices

9. "Before Hydraulic Fires Start"

   Available from: Monsanto Chemical Company
   St. Louis
   Missouri

10. "Working with Skydrol"

    Available from: Monsanto Chemical Company

11. "Elementary Hydraulics--Derivations of Pascal's Law Part I" (MN-1730A)

12. "Elementary Hydraulics--Derivations of Pascal's Law Part II" (MN-1730B)

13. "Elementary Hydraulics--Applications of Pascal's Law Part I" (MN-1730C)

14. "Elementary Hydraulics--Application of Pascal's Law Part II" (MN-1730D)

    Above films (#11 through 14) are Navy training films and may be available through local lending agencies. They may also be purchased from:

    DuArt Film Laboratories, Inc.
    245 West 55th Street
    New York, New York 10019

15. "Basic Hydraulics"

    Available from: Mrs. Paskon
    A. B. Chance Company
    Pitman Manufacturing Company Division
    P. O. Box 120
    Grandview, Missouri 64030

16. "Report on Cost Reduction and Control"

17. "Multipress..And How You Can Use It"

18. "Blanking and Forming"

19. "Index to Profits"

20. "Power-Up"

21. "Design for Power"

22. "Denison Capabilities"

23. "Axial Piston Pumps and Motors" (training film)

24. "Hydrostatic Pressure Control Valves" (training film)

Above films (#16 through 24) are available on a no-charge loan basis by addressing requests for a specific showing date to:

Advertising Department
Denison Divison
Abex Corporation
1160 Dublin Road
Columbus, Ohio 43216

APPENDIX F

APPENDIX F
MISCELLANEOUS

PROGRAMMED INSTRUCTION BOOKLETS:

United States Steel Corporation
525 William Penn Place
Pittsburgh, Pennsylvania

a. "Safety Contracts, Observations and Inspections"
b. "The Responsibilities of Supervisors"
c. "Outside Corporation Standard Cost System"
d. "Methods Improvement"
e. "Effective Instruction in Industry"
f. "Motivation for Improving Job Performance"

MOTOR FLEET MANAGEMENT PROGRAMS:

Institute of Public Safety
The Pennsylvania State University
310 Shields Building
University Park, Pennsylvania 16802

MAINTENANCE TRAINING PROGRAMS:

1. Terex Factory Service School
   Division of General Motors
   Hudson, Ohio 44236

2. Vickers Hydraulic School
   P. O. Box 302
   Troy, Michigan 48084

3. Joy Manufacturing
   c/o John Mahaffey
   525 Buffalo Street
   Franklin, Pennsylvania 16232

4. Multi-Amp Institute
   61 Myrtle Street
   Cranford, New Jersey 07016

5. Most heavy equipment manufacturers have training programs available from the local dealer, e.g., Caterpillar Company, Peoria, Illinois.

SHORT COURSES:

Short courses on various phases of mining are available from

Department of Mineral Engineering
The Pennsylvania State University
118 Mineral Industries Building
University Park, Pennsylvania 16802